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MONOGRAPH OF THE GENUS ARGEMONE FOR NORTH AMERICA AND THE WEST INDIES

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Introduction

The genus *Argemone* has been much neglected by American botanists during the past several decades and, in fact, has never been carefully and completely studied by any botanist of this country. The only notable attempts to revise the genus in its entirety have been by two Europeans, Sir David Prain and Dr. Friedrich Fedde. The lack of opportunity of these European students to carry out field work, and the limited numbers of herbarium specimens available for their studies imposed serious limitations. As a consequence, their revisions have become less useful through the years as more and more specimens have accumulated in herbaria and many anomalous forms needing taxonomic recognition have come to light. In the United States there has been an understandable reluctance among taxonomists during the past fifty years to describe new forms in this complex group in the absence of a recent comprehensive monographic treatment of the genus. It was with the intention of filling this need that the present monograph was undertaken.

The present study of *Argemone* encompasses a period of about ten years. The genus has been intensively studied in the field, laboratory and herbarium for the past six years. The descriptive portions of the present paper are based upon extensive suites of specimens from most of the major herbaria of the United States and upon my own collections. I have studied all of the taxa in the field except *A. fruticosa* and *A. subintegrifolia*. Many species have been successfully cultivated and chromosome numbers have been determined wherever feasible. Many preliminary studies on the crossability of the species cultivated have been carried out. First and second generation hybrids have been grown in many instances. Conclusions reached as to the closeness of relationships between various species as indicated by their crossability and the fertility of their hybrids have been taken into account in the present text in establishing the biological limits of these species. Limitations as to space, however, prevent an extensive account of these experimental studies in the present paper.

This monograph is restricted to the species of *Argemone* in North America and the West Indies. This leaves consideration of the several forms found in South America and the one species native to the Hawaiian Islands to a later date. I do not consider the present monograph to be more than a farther step toward a more complete understanding of the taxonomy and evolution of the genus. It has been necessary to offer only preliminary solutions to many taxonomic problems; many of these problems are pointed out at the appropriate places in the text. It is hoped that botanists geographically better situated to study these special problems than myself will be moved to do so.

Historical Review of the Taxonomic Literature

The first species of *Argemone* known to science was *A. mexicana* which was grown by John Gerard from seeds brought to him from St. Johns Island, West Indies, in 1592. Caspar Bauhin (1596, p. 311) was the first to publish a description of the species, under the name *Papaver spinosum*. His description was followed a year later by that of Gerard (1597, p. 993) who illustrated and discussed the species under the name *Carduus chrysanthemus peruanus*. Tournefort (1694, 1700) established the generic name *Argemone* in its modern sense. In it he placed only one species, Bauhin's *Papaver spinosum* which he referred to as *Argemone mexicana*. Species previously treated under *Argemone* were transferred by Tournefort to the genus *Papaver*.

Linnaeus (1753) included *Argemone* in his Polyandria Monogynia. He listed three species, viz., *A. mexicana*, *A. armeniaca* and *A. pyrenaica*. The genus, as a consequence, was unnatural in the Linnaean sense, since the latter two species according to all subsequent authorities belong to the genus *Papaver*. Lamarck (1783) re-establish *Argemone* in the Tournefortian sense by referring the alien elements to *Papaver* (see Poiret, 1804, p. 118). Lamarck (1783) was also responsible for first recording a white flowered "variety" of *A. mexicana*. This could be none other than the plant subsequently referred to by Lestiboudois (1799) as *Argemone alba*, a nomen nudum. The same white-flowered species was validly published as *A. albiflora* by Hornemann (1815).

The next *Argemone* to be described was *A. alba* James (1823), a later homonym of *A. alba* Rafinesque (1817). *A. alba* James falls into synonomy under *A. polyanthemos* in the present paper.

The next species of *Argemone* known to science were introduced into Europe by means of seeds from Mexico. These species, all described from cultivated plants, were *A. platyceras* Link & Otto (1830), *A. ochroleuca* Sweet (1829), *A. grandiflora* Sweet (1829), and *A. intermedia* Sweet (1830). All of these are clearly defined species except *A. intermedia* which was not illustrated as were the others; nor were specimens preserved in-so-far as I can determine. As a result, the correct application of this name has never been properly established.

The next species of *Argemone* to be described was *A. hispida* Gray (1849), followed by *A. munita* Dur. & Hilg. (1854). After this date no new discoveries were made in the genus until Greene described *A. corymbosa* (1886).

The first comprehensive revision of *Argemone* is that prepared by Dr. David Prain based upon specimens in the herbaria of London, Paris and Geneva, published in 1895. This revision is notable primarily for its

exhaustive coverage of the literature up to that time. All later students of the genus should refer to Prain's monograph in compiling bibliographic data, especially with regard to *A. mexicana*. Prain's discussion of the pre-Linnean and later literature is also of great value. Since he was a student of the family Papaveraceae his ideas of generic inter-relationships merit special attention. With regard to *Argemone* itself, Prain was extremely reluctant to describe new forms. He recognized a total of six species and five varieties, not counting the typical varieties, for a total of eleven named taxa for the world. He did not consider his treatment of the species of *Argemone* to be definitive in the least, stating (l.c., p. 177-178) that "the 'species' of this paper are in reality aggregations of forms that probably most botanists would recognize as specifically distinct." Two of the taxa treated by Prain are not considered in the present treatment, viz., *A. alba* var. *glauca*, really a distinct species endemic to the Hawaiian Islands, and *A. platyceras* var. *chilensis*, also a distinct species with at least two distinguishable subgroups. Still another distinct South American species with possibly two sub-groups was submerged in *A. mexicana* var. *ochroleuca* by Prain. Of the remaining nine taxa recognized by Prain, only one was new. This was *A. intermedia* var. *stenopetala*, certainly distinguishable, but more properly treated as a subspecies of *A. ochroleuca*. *A. fruticosa* and *A. grandiflora* were justifiably upheld by Prain, as was *A. mexicana* which, with the removal of var. *ochroleuca*, is a homogenous species. *A. mexicana* var. *ochroleuca* of Prain, when restricted to Mexico and Central America and when raised to full species status is probably biologically sound. *A. intermedia* var. *typica* Prain was not adequately typified and included a series of forms better treated as distinct species. *A. platyceras* var. *typica* Prain included not only *A. platyceras* L. & O., but several other taxa better treated as distinct species. *A. platyceras* var. *hispida* as circumscribed by Prain includes two components, true *A. hispida* and *A. munita* subspp. Finally, *A. alba* var. *typica* Prain, exclusive of Texas specimens, is *A. alba* Lestib., a name which should be replaced by *A. albiflora* Hornem. From this brief summary, it is evident that, with a few notable exceptions, Prain's understanding of the species of *Argemone* is reasonably valid today. Several of the taxa herein described as new were briefly mentioned by Prain, but in the light of his very limited knowledge of these groups he understandably refrained from formally proposing them as new.

During his lifetime, Dr. Edward L. Greene described several species of *Argemone*. *A. corymbosa* was described in 1886, *A. bipinnatifida*, *A. gracilenta* and *A. leiocarpa* in 1898, *A. sanguinea* and *A. squarrosa* in 1899, and *A. pleiacantha* in 1908. Of these, *A. sanguinea* is a new name for *A. platyceras* var. *rosea* Coulter; *A. leiocarpa* is the glabrous fruited form

of *A. mexicana* and seems to have been prompted by its mention in Prain's monograph, and *A. bipinnatifida* is clearly a synonym of *A. hispida* Gray. The remaining names were applied to good species previously not distinguished by taxonomists. Greene's published writings about *Argemone* are not extensive. His ability to recognize new forms does, however, indicate a wide familiarity with the species in nature.[1]

J. N. Rose (1903) published a brief but excellent account of the Mexican species of the *Argemone* with which he was familiar. He recognized eleven species for the area, one of which was newly described, viz., *A. arida*. The specimens referred to *A. hispida* by Rose are more correctly placed in *A. echinata* as herein described; those referred to *A. munita* actually belong to *A. pleiacantha* which was not distinguished until 1908. *A. stenopetala* (Prain) Rose is best left a subspecies of *A. ochroleuca*. The remaining names taken up by Rose agree in their application with that set forth in the present paper. It is notable that Rose did not apply the name *A. intermedia* to any Mexican species although this species was reputed to be a native of Mexico at the time of its original cultivation in England.

The most recent revision of *Argemone* for the world is that of Friedrich Fedde published in 1909 in Das Pflanzenreich. This revision is based very largely upon Prain's earlier publication, but embodies several advances especially with regard to the incorporation of several of E. L. Green's proposals. *A. corymbosa* is given recognition, but as a variety of *A. intermedia*. Similarly *A. gracilenta* and *A. pleiacantha* are recognized, but only as varieties of *A. platyceras*. *A. squarrosa* is given full species standing. On the other hand, several proposals seem to the present writer to be without merit. For example, Greene's *A. leiocarpa* is given full species standing and is divided into two varieties. Probably *A. leiocarpa* is no more than a form of *A. mexicana*. *A. ochroleuca* Sweet is left as a variety of *A. mexicana* regardless of differences which are of specific weight in *Argemone*. *A. purpurea* Rose is provided with a description for the first time without recognizing that it is synonymous with *A. sanguinea; A. sanguinea* is submerged in *A. platyceras*. *A. platyceras* L. & O. is not properly delimited and includes a mélange of forms more properly treated as distinct species. *A. intermedia* Sweet is allowed to stand without adequate typification and includes several distinguishable taxa. Never-the-

[1] In Greene's herbarium at Notre Dame University there is a handwritten manuscript entitled "Observations on Argemone," by Greene. This in actuality is a commentary on Prain's monograph and evidently was never completed or published. After some critical remarks about the lack of field knowledge of *Argemone* by Europeans and most Americans the manuscript ends with the words: "Meanwhile let me offer, as an original contribution to the knowledge of the genus, some geographic facts." No new information of value is included in the completed section of the manuscript.

less, Fedde's contribution to our understanding of *Argemone* is considerable and has the merit of being generally conservative. Its deficiencies may be attributed primarily to a lack of adequate study material upon which to base a sounder circumscription of species and varieties. Also, Fedde did not have a first hand knowledge of the distributional aspects of the species of *Argemone* and much unnecessary lumping of taxa and incorrect disposition of individual specimens may no doubt be traced to this factor. .

History of Cultivation

The first *Argemone* to be introduced into Europe was *A. mexicana* first cultivated by Gerard. On the authority of Aiton (1811), Sweet (1830) and Loudon (1830), all of whom evidently refer back to Clusius, the date of introduction was 1592. The first mention of the species in literature was by Bauhin (1596) and by Gerard (1597), the latter having received seeds of the species from St. Johns Island in the West Indies. It has been in more or less continuous cultivation in Europe since its introduction. The next species to be introduced into cultivation appears to have been *A. albiflora,* first mentioned by Lamarck (1783) as the white-flowered variety of *A. mexicana.* The actual date of introduction was prior to 1783, but I know of no account of exactly when or under what circumstances it was introduced into Europe. It was introduced to the gardens at Copenhagen in 1812 according to Hornemann (1815), and into England in 1820 (Sweet, 1830) or 1821 (Loudon, 1830). It evidently enjoyed its greatest popularity in gardens before the introduction of other species between 1827 and 1830. *A. ochroleuca* was introduced into Europe before 1790 according to Prain (1895, pp. 208, 328) but was not continued in cultivation. Prain's basis for this statement was a specimen cultivated at Paris in the eighteenth century and preserved in the A. L. Jussieu herbarium. The species was again introduced, into England, in 1827 according to Sweet (1830) and has since remained in cultivation. *A. grandiflora,* the best of the white-flowered species for gardens, was also introduced into England in 1827 according to Sweet (1830), Loudon (1830) and Prain (1895, p. 333). It has been in cultivation since that date. Another species, *A. intermedia,* was introduced into England from Mexico in 1828, according to Sweet (1830, 1839). I have been unable to establish the identity of this species, but it almost certainly is not the same as the species of the Great Plains to which the name has been applied for the past sixty years (*A. polyanthemos* of this paper). At any rate, *A. intermedia* Sweet did not continue in cultivation and seems to be listed nowhere else in the literature of the period. The white-flowered species of the Great Plains, *A. polyanthemos,* was introduced into England from Colorado in 1877 by J. D. Hooker and

was figured by Hooker (1878) under the name *A. hispida*. It was not continued in cultivation. *A. platyceras* was introduced into Europe in 1829 according to Link & Otto (1830) and flowered at Berlin in 1829 and 1830 without, however, bearing seeds. Prain (1895, p. 365) states that *A. intermedia* var. *stenopetala* (i.e., *A. ochroleuca* subsp. *stenopetala* of this paper) was cultivated by Cosson from seeds taken from specimens sent to him by Pringle. Specimens of the garden plants are preserved, according to Prain, in the Cosson herbarium at Paris. The date of cultivation was not earlier than 1885 since this is the year Pringle first collected the subspecies.

The period of greatest popularity of *Argemone* in the gardens of Europe was 1827-1840 according to Prain (1895, p. 129). In the United States, none of the species of this genus has ever achieved any great popularity in gardens. *A. mexicana* and *A. grandiflora* have been cultivated more or less continuously but never widely. *A. platyceras, A. sanguinea, A. munita* subsp. *munita, A. polyanthemos* (as *A. intermedia*) and probably other species, have also been cultivated occasionally. Species which merit further attention as subjects for gardens are *A. sanguinea, A. polyanthemos* and *A. aenea.*

Medicinal Use

The use of *Argemone* for medical purposes is recorded by numerous authors. In Puerto Rico, Cook and Collins (1903) report that the seeds of *A. mexicana* are employed as a purgative, as a substitute for ipecacuanha, and that the juice is used in the treatment of ophthalmia. This species and others are similarly utilized throughout Latin America and also for a wide variety of other ailments. The active principles in *Argemone* appear to be alkaloidal in nature, but very little scientific work on their identification and medicinal uses has yet been done.

Common Names

A. mexicana was referred to by Gerard (1597) as "The golden Thistle of Peru." The seeds received by him carried the Spanish name of the day "Figue del Inferno." In Britton & Brown (1913) *A. mexicana* is termed the "Mexican Prickly or Thorn Poppy," also "Bird-in-the-bush, Devil's fig, Yellow, Flowering or Jamaica thistle." In Jamaica, according to Fawcett & Rendle (1914), *A. mexicana* is called "Prickly Poppy," "Gamboge Thistle," or "Mexican Thistle." In the Bahama Islands, according to Britton & Millspaugh (1920), *A. mexicana* is termed the "Donkey thistle" or "Mexican Poppy." In Bermuda, Britton (1918) states that the names "Mexican Poppy," "Prickly Poppy," "Stinging Thistle," and

"Queen Thistle" are applied to *A. mexicana.* In Mexico, according to Martínez (1937) the name "Cardo" is applied to *A. mexicana* as well as to other species; "Cardo Santo" is used for *A. mexicana* and *A. fruticosa; A. grandiflora* is called "Chacalote" or "Chicalota Grande"; "Chicalote" is used for *A. mexicana, A. ochroleuca* and also *Bocconia* sp.; and "Chicalotl" is used exclusively for *A. mexicana* and *A. ochroleuca.* Standley & Steyermark (1946), for Guatemala, list the following names for *A. mexicana:* "Chicalote," "Cardosanto," "Cajhuoc," "Ixmucur," "Kixatucan," "Sajouix," and "Cahhouc." In North America north of Mexico the common name "Prickly Poppy" is used for all species of *Argemone;* when reference is made to one of the yellow-flowered species, usually *A. mexicana,* it is usually termed "Mexican Poppy."

Geographical Distribution

Argemone is an exclusively American genus with the exception of one species endemic to the Hawaiian Islands. In North America there are twenty-three species recognized in the present paper. These are found along the coastal areas of southeastern and southern United States to Texas, thence westward to the Pacific and northward across the Great Plains to western South Dakota and southern Montana; in the far west *Argemone* is found throughout the desert regions and northward across the Great Basin to northern California and southeastern Oregon. *Argemone* is present throughout Mexico and Central America except in the higher mountains, and throughout the islands of the West Indies. In South America there are four or five recognizable taxa found in Chile, Argentina, Uruguay, Paraguay, Bolivia and northward along both coasts to the Isthmus of Panama. *Argemone mexicana* is introduced into all tropical and subtropical regions of the world; *A. ochroleuca* is introduced into Australia. In North America the species of this genus occur almost exclusively in regions of low rainfall at elevations of near sea level to 8,000 feet, rarely more; when they occur in areas of moderately heavy rainfall they are found only in soils of low water-holding capacity. Many species spread rapidly into newly disturbed areas; many are incipient weeds in fields and about dwellings within their natural distributional areas and in adjoining regions. For this reason the absolute distributional boundaries of many species before the introduction of modern agricultural practices is difficult if not impossible to establish.

Man has played an important role in the dispersal of the seeds of *Argemone* in the past. This role has probably been passive in most instances; either the seeds have been carried along as contaminants in the seed of crop plants of a similar size or the seeds have been mixed with

other materials transported from place to place; in the case of *A. mexicana* the seeds probably have been carried from port to port in ship's ballast. In the southwest and in Mexico *Argemone* is often closely associated with cultivated fields and dwellings of man. It is avoided by all livestock, and because of the prickliness of its stems and leaves survives successfully where most other plants would be eliminated. Man has undoubtedly played an active role in the dispersal of *A. mexicana* and *A. ochroleuca* because of the supposed medicinal properties of these plants previously mentioned.

The usual natural forces of wind and water also are effective in the dispersal of the seeds of *Argemone*. Certain features of the seed seem to the writer to be especially important in their dispersal by water. First, the seeds are covered by a thin coat of wax which inhibits the absorption of water; then, the shallow pits in the seed coat appear to act as air traps when the seeds are placed in water; finally, in the seeds examined, there was a small air pocket under the seed coat beneath the micropyle. The first of the features prevents the immediate water-logging of the seed when it comes into contact with water; the latter two features add to its buoyancy. Taken together they would appear to enhance the chances of water transport of the seeds under favorable conditions. When the seeds of *Argemone* are placed in water in the laboratory, they float on the surface for one to several days.

Generic and Intrageneric Relationships

Argemone is set apart from other genera of the Papaveraceae by several important features including the basically trimerous arrangement of the sepals and petals, the presence of sepal horns, the united styles and the mode of dehiscence of the capsules. None of these features taken individually is peculiar to *Argemone* but their presence in combination in *Argemone* forms the basis for the taxonomic delimitation of the genus. For example, trimery and horned sepals are found in species of *Papaver;* capsules of *Meconopsis* and *Romneya* dehisce much as they do in *Argemone;* united styles are found in *Meconopsis*. *Argemone* is placed in the tribe Papavereae by Fedde (1909) along with *Meconopsis, Papaver, Canbya, Cathcartia, Roemeria* and *Glaucium*. The genus appears to be most closely related to *Papaver* and *Meconopsis*.

Some effort has been made without success to discover groupings of species in *Argemone* which might form the basis for establishing sections within the genus. There is no evidence for the existence of groupings of this magnitude. Some poorly definable alliances among species may, however, be pointed out, but there are many species which cannot be assigned with any assurance to any alliance, nor do the alliances themselves appear

to have any high degree of reality. For example, *A. mexicana* and *A. ochroleuca* and possibly also *A. aenea* and *A. superba* form one alliance; *A. echinata, A. squarrosa, A. aurantiaca, A. pleiacantha, A. hispida* and *A. munita,* in part, and possibly *A. platyceras* form another alliance; *A. albiflora, A. polyanthemos, A. grandiflora* and *A. gracilenta* form still another alliance. Several species such as *A. fruticosa, A. corymbosa* and *A. subintergrifolia* seem to have no very close relatives; the remaining species do not fit well into any of the above alliances, yet are close to one or more of them. It is probably unwise to attempt any taxonomic subdivision of *Argemone* above the rank of species.

Species Concept

In delimiting the species of *Argemone,* I have been guided by the following generalizations. When two taxa are sympatric over a part of their ranges and evidence indicates that they hybridize readily in this area they are generally treated as subspecies of the same species. If there is no visual evidence of hybridization between the two taxa they are treated as distinct species. When the ranges of two taxa are allopatric but experience with greenhouse cultures indicates that they may be crossed readily and produce rather highly fertile offspring they are also generally treated as subspecies of the same species. If two taxa occupy allopatric ranges and consequently are effectively isolated spatially and, further, if their crossability is unknown, then they are treated as distinct species.

Differences in ploidy level between individuals of different breeding populations or of those within a single population have not been considered to be of nomenclatorial relevance unless accompanied by morphological differentiation. Such differences in ploidy level may obviously be of great biological significance in their effects on the breeding behavior and evolution of the species. It happens, however, that in *Argemone* the ploidy level is constant in most species insofar as has been determined; conversely, differences in ploidy level are generally accompanied by morphological differentiation of sufficient magnitude to warrant a degree of taxonomic recognition.

Speciation

The present study indicates that the most important factor leading to speciation in *Argemone* is geographic isolation followed by the accumulation of genetic differences in the isolated populations. One of the most interesting features of the genus is the manner in which one species is replaced by another geographically. In the United States, *A. polyanthemos* is replaced to the west and southwest by *A. hispida* and *A. squarrosa* subspp.

and these are replaced by *A. gracilenta, A. corymbosa* subspp. and *A. munita* subspp. still farther west. To the south and southeast, *A. polyanthemos* is replaced by *A. chisosensis, A. albiflora* subsp. *texana* followed by *A. sanguinea* and *A. aenea.* Other species occupy smaller but discrete ranges within this larger area. There is, of course, some overlapping of distributional ranges, but these are more apparent than real. This is because the two partially sympatric species occupy different ecological positions. In Mexico, similar conditions to those in the United States prevail. All of the Mexican species have partially or wholly discrete geographical ranges.

Many diploid species such as *A. albiflora* and *A. polyanthemos* appear to maintain their identities mainly because of geographic isolation. Breeding experiments indicate that these two species will cross readily under experimental conditions. *A. gracilenta,* a diploid species mainly of the Sonoran Desert, is perfectly distinct over most of its range, but appears to hybridize with *A. pleiacantha* subsp. *pleiacantha* where the latter has been introduced into its range.

Another factor which has played a role of some significance in *Argemone* speciation is polyploidy accompanied by reproductive isolation. It is postulated that *A. ochroleuca* may have arisen as an autotetraploid of *A. mexicana.* These species are very much alike in general characteristics and reproductive behavior. Plants of both species are highly self-compatible, and both species exhibit a high degree of crossability with other species. *A. mexicana* now occupies a very different geographical range from *A. ochroleuca* (see Fig. 5), and the occurrence of the former in the range of the latter may be attributed entirely to introductions. Diploid and tetraploid races herein included under *A. sanguinea* occupy slightly different though adjacent geographical areas and exhibit some inconstant morphological differences. This type of variation might easily lead to speciation. Two species which are effectively isolated from all others are *A. aurantiaca,* a hexaploid, and *A. squarrosa* subsp. *squarrosa,* probably an octaploid. These two species may be crossed with diploid and tetraploid species under experimental conditions, but the resultant highly unbalanced genomes in the F_1's lead to complete sterility of these hybrids.

The presence of sterility barriers between individual species pairs in *Argemone* are not uncommon, although the exact nature of these barriers has not been investigated. For example, *A. platyceras* has been successfully crossed with only one other species to date, namely, *A. mexicana,* but attempts to cross it with its nearest relative, *A. arida,* have not been made. Once sterility barriers have formed between segments of a population, even though they are not complete, the potentiality for genetic drift, either morphological or in the direction of different ecological amplitudes (i.e.,

differing habitat optima), or more likely both, may lead to speciation. Probably this factor is involved in speciation within the genus *Argemone*. It is unlikely, however, that sterility barriers have played the primary role.

Hybridization

Well authenticated instances of natural hybridization in *Argemone* are not numerous. This is partly due to lack of opportunity for hybridization since over most of the geographical range of the genus the species are spatially or ecologically isolated from each other. Well authenticated instances of putative natural hybridization, however, do occur, the best example between *A. munita* subsp. *munita* and *A. munita* subsp. *rotundata* in southern California in a small area of sympatric distribution where hybrid swarms of the two are common. Curiously enough, plants of intermediate character occur far up the coastal ranges where neither subspecies is found in typical state. This is the main basis for placing these two taxa in the same species, the two being otherwise sufficiently distinct and separated geographically to justify treating them as separate species. In Sonora, single hybrid plants of *A. pleiacantha* subsp. *pleiacantha* X *A. ochroleuca* subsp. *ochroleuca* are not uncommon, but these always appear to be F_1 hybrids which do not reproduce. The latter species is almost certainly introduced into the area where the hybrids occur. *A. gracilenta* appears to hybridize with *A. pleiacantha* subsp. *pleiacantha* and *A. pleiacantha* subsp. *ambigua* in southern and western Arizona in and near the areas of distributional overlap. *A. polyanthemos* and *A. albiflora* subsp. *texana* seem to hybridize freely in north-central Texas. In southern Texas several introduced and native argemones are found in more or less close proximity. The variation patterns of such species as *A. sanguinea* (diploid and tetraploid) and *A. albiflora* subsp. *texana* (diploid) in this area are not understood; part of this variation may be due to genetic interchange between these and other species. Further studies on the southern Texas argemones are much needed.

The classical work on controlled interspecific hybridization in *Argemone* is that of Vilmorin (1912). Vilmorin succeeded in crossing *A. mexicana* and *A. platyceras* and in growing first and second generation progeny. From the distribution given for *A. platyceras*, i.e., Rocky Mountains: Wyoming, Nebraska, Texas, one might suspect that Vilmorin's *A. platyceras* was actually *A. polyanthemos*. For reasons clarified below, I am of the opinion that he was working with true *A. platyceras* from Mexico. Vilmorin reported segregation in the F_2 for flower size and color, stem color, latex color, stature, abundance of foliage, color of the nerves, etc. Monstrosities resulting from malformations of the floral organs were also

reported, e.g., stamens transformed into carpels. Most important, he reported that some F_2 plants had flowers with petals of varying shades of buff. Since one parent had bright yellow petals and the other white, recombinations giving a new color are of extraordinary interest.

I have repeated Vilmorin's experiments exactly with parental stocks of known origin and have obtained identical results. I have, unfortunately, been unable to grow large populations of F_2 plants, having succeeded in rearing to maturity a total of only 36 plants. Only one plant had "buff" (actually bronze-colored) petals and, interestingly, this plant was identical to *A. aenea* of Texas and northeastern Mexico. This experiment should be repeated for absolute confirmation with large populations, and, if *A. aenea*-like progeny are recovered, a further step should be taken, that is, selection in succeeding generations with a view to reconstituting *A. aenea*. I am not at all sure that this cross is the one actually involved in the evolution of *A. aenea*, although *A. mexicana* is almost certainly one of the parents. The other parent is more likely a lavender-flowered, diploid race of *A. sanguinea*. The bronze color of the petals in *A. aenea* is possibly resultant from the presence of both purple and yellow pigments. Although lavender filaments are generally present in *A. platyceras*, the coloration does not carry over to the petals in-so-far as is known.

Numerous other attempts at controlled crossing of *Argemone* species have been made by the writer in the greenhouses at the University of Minnesota. The species most often involved in these crosses have been *A. mexicana*, *A. ochroleuca* subsp. *ochroleuca*, *A. platyceras*, *A. polyanthemos*, *A. albiflora* subspp., *A. aenea*, *A. grandiflora* subspp., and *A. sanguinea*. Publication of details of these experiments must be deferred to a later date, but some generalities may be mentioned here. Experimental hybridization between many species of *Argemone* is possible, and no species seems to be completely isolated from all other species by sterility barriers. *A. platyceras* is most nearly isolated; crosses of this species were successful only with *A. mexicana* among several species tried. *A. mexicana* and *A. ochroleuca* can be successfully hybridized with most if not all other species. Interspecific crosses can be carried beyond the first generation only if the ploidy levels of the parental species are the same. Numerous first and second hybrid generation populations were grown in the experimental gardens of the University of Minnesota and the Rancho Santa Ana Botanic Gardens. In general, a marked loss in vigor and fertility in F_2 plants was evident. This indicates the prevalence of incompatible genomes in *Argemone* species even among those which are crossable under experimental conditions.

Chromosome Numbers

Chromosome numbers have been determined for the species listed in the table below. Root tip sections have been employed in making most of these counts. In *A. corymbosa, A. gracilenta, A. munita* and *A. pleiacantha* the counts have been made from PMC squashes.

It is evident from the table that most species of *Argemone* have a somatic chromosome number of 28. The polyploids form a nearly regular series with known somatic chromosome number of 56 (4 species), 84 (1 species) and ca. 112 (1 species). A meiotic number of 14 is recorded for two putative hybrids between *A. ochroleuca* and *A. pleicantha*. This is at variance with the expected situation in an F_1 cross between these two species, the former a tetraploid, the latter a diploid. Herein lies indirect evidence that *A. ochroleuca* may sometimes have a somatic chromosome number of 28. Pairing of the chromosomes at Metaphase-I was nearly regular in the hybrids.

The chromosome counts listed below have all been made by myself over a period of several years. The only other counts for this genus known to me are those reported by Sugiura. Sugiura (1936, p. 570) reports the meiotic number for *A. grandiflora* as 28 and that for *A. mexicana* as 14. These counts are in agreement with my own studies. Sugiura (1940, p. 564) further reports the meiotic number for *A. barclayana* as 14. I do not know which species is referred to by this name, since in my opinion the binomial falls into synonomy under *A. ochroleuca* subsp. *ochroleuca*, a tetraploid with 56 somatic chromosomes over most of its range, with the possible reservation noted above. I agree with Sugiura (1940) that the basic chromosome number in the genus may be 7, but it now appears doubtful if any species with a meiotic number of 7 survive.

General Morphology

Roots: Seedlings of *Argemone* initially produce a strong tap root in all species observed. In certain species such as *A. polyanthemos*, when growing in sandy soil, the tap root may penetrate to a depth of two or more feet. In other species large lateral roots soon develop and the root system is consequently more diversified.

Stems: In all of the herbaceous species of *Argemone* the young plants first produce a basal rosette of leaves. A main stem then arises from the apex and often one or more additional stems arise concurrently from axillary buds near the base of the plant. Often, however, the axillary buds do not become active until after growth of the central stem has ceased and may even be delayed until the advent of the next growing season.

TABLE I

Species	Collector and number	Locality where collected	Garden number	n	2n
A. aenea	*G. B. Ownbey & F. Ownbey 1409*	17.5 mi. n.w. of Montemorelos, Nuevo Leon, Mexico	A-50- 2 A-50- 5		28
	F. G. Meyer & D. J. Rogers 2479	54 mi. s. of Matamoros, Tamaulipas, Mexico	A-12- 1		28
A. albiflora subsp. *albiflora*	*G. B. Ownbey & F. Ownbey 1350*	Savannah, Chatham Co., Georgia	A-35- 5		28
	G. B. Ownbey & F. Ownbey 1375	Carrabelle, Franklin Co., Florida	A-37- 2 A-37- 5		28
	G. B. Ownbey & F. Ownbey 1379	4.5 mi. e. of Gulfport, Harrison Co., Miss.	A-39- 2 A-39- 3		28
A. albiflora subsp. *texana*	*C. B. Heiser s.n.*	Brazos River, Hwy. 21, Burleson Co., Texas	A-24- 1		28
	C. B. Heiser s.n.	Athens, Henderson Co., Texas	A-25- 1		29
	G. B. Ownbey & F. Ownbey 1387	4.3 mi. e. of Hempstead, Waller Co., Texas	A-43- 1 A-43- 4		28
A. arida	*G. B. Ownbey & F. Ownbey 1444*	1.6 mi. s.e. of Nombre de Dios, Durango, Mexico	A-59- 4		28
	B. G. Ownbey & F. Ownbey 1447	6.3 mi. n.e. of Villa Madero, Durango, Mexico	A-60- 1 A-60- 2		56
A. aurantiaca	*C. B. Heiser s.n.*	Selma, Bexar Co., Texas	A-21- 2 A-22- 1 A-22- 4		84
	G. B. Ownbey & F. Ownbey 1394a	5.3 mi. s.e. of Austin, Travis Co., Texas	A-44- 1 A-44- 5		84
A. corymbosa subsp. *arenicola*	*G. B. Ownbey & F. Ownbey 2146*	37.9 mi. s.w. of Green River, Emery Co., Utah		28	
	G. B. Ownbey & F. Ownbey 2164	21.8 mi. s.w. of Bluff, San Juan Co., Utah		28	
A. echinata	*G. B. Ownbey & F. Ownbey 1408*	2.1 mi. n. of Saltillo, Coahuila, Mexico	A-49- 1 A-49- 9		28
A. gracilenta	*G. B. Ownbey & F. Ownbey 2079*	2.2 mi. s. of Villa de Seris, Sonora, Mexico		14	
	G. B. Ownbey & F. Ownbey 2079a	3.7 mi. s. of Villa de Seris, Sonora, Mexico		14	
A. grandiflora subsp. *armata*	*F. G. Meyer & D. J. Rogers 2836, in part*	Hacienda Santa Engracia, 40 mi. n.w. of Victoria, Tamaulipas	A-13- 6 A-13-10		56
	G. B. Ownbey & F. Ownbey 1406	Santa Catarina, Neuvo León, Mexico	A-48- 2		56

TABLE I (continued)

Species	Collector and number	Locality where collected	Garden number	n	2n
A. grandiflora subsp. *grandiflora*	*R. Straw M18*	El Pinalito, Hidalgo, Mexico	A-3 - 5		56
	R. Straw M61, M62	ca. 6 mi. e. of Ciudad del Maíz, San Luis Potosí, Mexico	A-8 - 1 A-9 - 3		56
	G. B. Ownbey & F. Ownbey 1420	30.4 mi. s. of Jacala, Hidalgo, Mexico	A-52- 1 A-52- 5		56
A. mexicana	*F. G. Meyer & D. J. Rogers 2677, in part*	8 mi. e. of Dulces Nombres, Nuevo León or Tamaulipas, Mexico	A-11- 3 A-11- 5		28
	Cultivated, Univ. Minnesota	Origin unknown	A-16- 1		28
	G. B. Ownbey & F. Ownbey 1357	St. Augustine, St. John's Co., Florida	A-40- 3 A-40- 5		28
	G. B. Ownbey & F. Ownbey 1366	South Miami, Dade Co., Florida	A-41- 2 A-41- 4		28
A. munita subsp. *argentea*	*G. B. Ownbey & F. Ownbey 2113*	Beal Well, Imperial Co., California		14	
A. munita subsp. *munita*	*G. B. Ownbey & F. Ownbey 2112*	2.8 mi. s.e. of Palm Springs, Riverside Co., California		14	
	G. B. Ownbey & F. Ownbey 2171	1.6 mi. s.w. of Emory store, San Diego Co., California		14	
A. munita subsp. *robusta*	*G. B. Ownbey & F. Ownbey 2177*	Santiago Peak, Orange Co., California		14	
A. munita subsp. *rotundata*	*G. B. Ownbey & F. Ownbey 2168*	2.0 mi. w. of Cajon Junction, San Bernardino Co., California		14	
A. munita subsp. *munita* X subsp. *rotundata*	*B. G. Ownbey & F. Ownbey 2170*	0.1 mi. w. of Radec, Riverside Co., California		14	
A. ochroleuca subsp. *ochroleuca*	*F. G. Meyer & D. J. Rogers 2677, in part*	8 mi. e. of Dulces Nombres, Nuevo León or Tamaulipas, Mexico	A-11- 1 A-11- 4		56
	G. B. Ownbey & F. Ownbey 1421	7.9 mi. n. of Tasquillo, Hidalgo, Mexico	A-53- 1 A-53- 2		56
	G. B. Ownbey & F. Ownbey 1443	17.1 mi. n.w. of Sombrerete, Zacatecas, Mexico	A-58- 4		56
	G. B. Ownbey & F. Ownbey 1460	3.5 mi. s.e. of Meoqui, Chihuahua, Mexico	A-63- 2 A-63- 5		56
A. ochroleuca subsp. *ochroleuca* X *A. pleiacantho* subsp. *pleiacantha*	*G. B. Ownbey & F. Ownbey 2078*	3.6 mi. n. of Imuris, Sonora, Mexico		14	

TABLE I (continued)

Species	Collector and number	Locality where collected	Garden number	n	2n
	G. B. Ownbey & F. Ownbey 2088	3.1 mi. n.e. of Santa Ana, Sonora, Mexico		14	
A. platyceras	*R. Straw M33*	ca. 12 mi. s.e. of Puebla, Puebla, Mexico	A-4 - 5		28
	R. Straw M38	1.1 mi. w. of Puebla, Puebla, Mexico	A-5 - 3		28
	R. Straw M39	ca. km. 114 w. of Mexico City, Mexico	A-6 - 1 A-6 - 2		28
	R. Straw M40	near San Juan Paracutín, Michoacan, Mexico	A-7 - 1 A-7 - 2		28
A. pleiacantha subsp. *pleiacantha*	*G. B. Ownbey & F. Ownbey 2077*	15.2 mi. s. of Nogales, Sonora, Mexico		14	
A. polyanthemos	*E. Anderson s.n.*	30 mi. e. of Amarillo, Carson Co., Texas	A-20- 3		28
	G. B. Ownbey & F. Ownbey 1298	25.2 mi. s. of Custer, Custer Co., S. Dokata	A-26- 2		28
	G. B. Ownbey & F. Ownbey 1323	7.9 mi. n.w. of Gothenburg, Lincoln Co., Nebraska	A-30- 4 A-30- 5		28
A. sanguinea	*V. L. Cory 55221*	4¾ mi. e. of Falfurrias, Brooks Co., Texas	A-19- 3		56
	B. E. Harrell 152	9 mi. s.e. of Laredo, Webb Co., Texas	A-18		28
	C. B. Heiser s.n.	Carrizo Springs, Dimmit Co., Texas	A-23- 1 A-23- 2		28
	G. B. Ownbey & F. Ownbey 1451	57.3 mi. w. of Gómez Palacio on road to Mapimí, Durango, Mexico	A-71- 1 A-71- 2		ca. 58
A. squarrosa subsp. *squarrosa*	*G. B. Ownbey & F. Ownbey 1477*	0.6 mi. s.w. of Capitan, Lincoln Co., New Mexico	A-67- 1 A-67- 2		ca. 112

Branching of the stem of *Argemone* is sympodial, i.e., growth of each primary, secondary, tertiary, etc., axis is in turn arrested by the formation of a terminal flower bud. It is usual for the axillary shoot or shoots nearest the primary flower bud of each axis also to produce terminal flower buds immediately. The branch system develops concurrently in its various parts, but the sequence of maturation of flowers and fruits in each part of the system is always the same, the terminal flower or fruit of each axis being the most advanced.

In many cases the inflorescence of *Argemone* is clearly a cyme as delimited by Rickett (1955); in other cases, although it is structurally identical, it fits this definition of a cyme less well since through overtopping of

the main axes by the lateral axes the flat topped character is lost. In these cases, which are numerous, the inflorescence could as well be termed a panicle in Rickett's proposed usage for the term.

With rare exceptions, viz., in *A. grandiflora* and *A. mexicana* f. *leiocarpa,* the stems of *Argemone* are always prickly to a greater or lesser extent. The amount of prickliness varies within wide limits between species and sometimes within a single species. The amount of prickliness is of considerable diagnostic importance, but is extremely hard to express descriptively. A better idea of this characteristic in a given species may be gained by the reader from the illustrations.

Leaves: The leaves of *Argemone* must be considered to be epetiolate since a clearly defined petiole is not present. In the lowermost leaves, which are obovate or oblanceolate, the blade becomes quite narrow near its point of attachment and, in a sense, might be considered to have a winged petiole. The middle and upper cauline leaves are definitely sessile and elliptical to sometimes ovate. Those of the uppermost extremities of the stem, in most species, are much reduced and bracteate.

The leaf blades, beyond the seedling growth stages, are always lobed to some extent except, insofar as is known, in *A. subintegriofolia.* On a given plant the lower cauline leaves, but not necessarily those of the basal rosette, are the most deeply lobed. The leaves are regularly less deeply lobed and reduced in size upward.

The margins of the leaves are invariably toothed, sometimes closely so. Each tooth, regardless of its size, is always terminated by a prickle.

The surfaces of the leaves range from smooth to closely prickly or crisped-hispid. The prickles are confined to the main veins in many species but, as the amount of prickliness increases, they also occur on the lesser veins and on the intervein areas in extreme cases.

Buds: The buds of *Argemone* vary greatly in shape just prior to anthesis, from subspherical to elliptical, oblong, or obovate. The sepals normally are three in number, but the number may vary from two to six and is not necessarily constant on a single plant. They are fugacious and deciduous at anthesis. Each sepal has a hollow, subterminal horn tipped by a solid prickle. The length and shape of the sepal horns is of some diagnostic value. The sepals in the bud are imbricated. The overlapped portion is of thinner, more delicate texture and is regularly prolonged into an acute or obtuse tooth at the distal end. The petals, which reach their full size just before anthesis, are crumpled in the bud upon release from the confinement imposed by the sepals at anthesis rapidly assume their mature shape.

Flowers: The flowers when fully opened are saucer-shaped or bowl-shaped. Normally there are six petals in two whorls of three each. The

individual petals are narrowly elliptical in *A. ochroleuca* subsp. *stenopetala* to approximately obcuneate in *A. ochroleuca* subsp. *ochroleuca* and *A. platyceras*. They are obovate or suborbicular in *A. albiflora, A. munita* and *A. gracilenta* as well as many other species. In a single flower, the petals of the outer whorl tend to be broader and more rounded distally than the petals of the inner whorl. The floral anatomy of *Argemone* and other papaveraceous genera is discussed by Murbeck (1912).

Stamens: the stamens in *Argemone* are numerous, but the number for each species usually falls within roughly definable limits. They occur in an indefinite number of series. The extrorse anthers are linear, 2-celled and dehiscent along their entire length. The filaments are thread-like (narrowly clavate in *A. glauca* of the Hawaiian Islands), basifixed and abruptly contracted at the point of attachment to the anther.

Pistils: The pistil consists of a 3-7-lobed stigma, a short or obsolete style, and a 3-7-carpellate ovary with as many placentae. The felt-like stigma is lobed by virtue of the down-warping and expansion of the stigmatic surfaces opposite the placental strands. The lobes formed by the down-warped stigmatic tissue are distally concave and more or less tubular proximally. The style consists mainly, if not entirely, of the fused placental strands. It is solid at anthesis but a slender central channel may develop later. Free but very limited passage of air to and from the interior of the ovary is then possible. The ovary is unilocular with parietal placentation. The anatropous ovules are numerous and uniformly oriented with the micropyle pointed towards the base of the ovary. The medial plane of each ovule is at right angles to the surface of the placenta insofar as space permits. The raphe is conspicuously umbonate at the chalazal end in the species observed.

Capsules: The capsules at maturity vary greatly in shape, from narrowly elliptical to oblong, lanceolate or ovate. The surface is always spinescent to a greater or lesser degree except in *A. mexicana* f. *leiocarpa*. There are 3-7 carpels; each carpel consists of a broad reticulate-veined valve which it attached along the margins to an adjacent vascular strand underlying a placenta. At maturity the valves break away apically from the associated vascular strands for about one-third of their length. The exposed strands remain in place and form a cage-like framework which terminates in the persistent stigma and style. The seeds are dispersed, often over long periods of time, through the openings between the strands.

Seeds: The seeds of *Argemone* are subspherical or slightly tapered towards the micropyle. A slender but often prominent beak is formed at the micropyle. The hilum is small and often obscure. The raphe is straight and often definitely umbonate at the chalazal end. The testa is described in all the older literature as being scrobiculate and I have found no better

term. Shallow depressions cover the entire surface. The depressions are arranged in more or less definite longitudinal rows between the chalaza and the micropyle. The ones farthest from the raphe are the most pronounced; those nearest the raphe are the least pronounced. The greatest dimension of the seed varies from 1-3 mm. The size range within a species is sufficiently narrow to be of taxonomic value. The diameters of the depressions in the testa vary in direct proportion to the sizes of the seeds and, as a consequence, this feature has proved to be of little taxonomic use.

Seedlings: Upon germination of the seed a deep tap root is rapidly developed; its ultimate length is at least in part controlled by the type of soil and availability of moisture in the surface layers. The cotyledons are linear and entire. The first few leaves are unlobed but are obtusely angled marginally. Later leaves are progressively dentate, lobed or even pinnatifid, depending on the species, until the adult leaf forms appear.

Other Features of Taxonomic Value

Longevity: In all species of *Argemone* with the possible exception of *A. fruticosa* the plants probably are capable of completing their life cycle in a single growing season. Plants of many species are capable of perennating by means of the persistent root and crown and the activation of latent, sub-basal axillary buds when conditions are favorable. Life span of the individual plants thus sometimes may be of taxonomic value.

Petal color: As a whole, the color of the petals in *Argemone* exhibit considerable variation, although the prevailing color is white. Many individual plants of *A. sanguinea* and *A. chisosensis* have petals of pale to dark lavender, but white petals often are present in both species. Several species have petals which are of yellow color, for example, *A. mexicana*, *A. ochroleuca* and *A. fruticosa*. Flowers of a single plant have a uniform color of petals in all instances. The petals remain attached for a comparatively short time, usually for no more than two or three days.

Latex color: Abundant latex is present throughout the plant in all species of *Argemone*. According to Metcalfe and Chalk (1950), the latex is reported to be contained in articulated laticiferous tubes in this genus. Whether or not its occurrence is restricted to these tubes or is sometimes found in laticiferous sacs as in some other papaveraceous genera evidently is not known. The amount of "bleeding" of a freshly broken stem is often considerable. This would lead one to believe, therefore, that the latex is generally if not universally present in tubes and that there is drainage to the break from some distance up and down the stem. The latex, when fresh, varies greatly in color and this feature often is of diagnostic importance. In such species as *A. hispida*, *A. gracilenta* and *A. munita* it is

generally very pale lemon-yellow; in other species, for example, *A. mexicana, A. ochroleuca* and *A. polyanthemos* it is generally bright yellow. In *A. corymbosa* the latex is distinctly orange and in *A. aurantiaca* it is consistently reddish-orange. Upon drying, the latex of all species turns to a deep brownish-black color.

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Herbarium Abbreviations

The herbarium abbreviations used in this paper are in accord with those listed by Lanjouw and Stafleu (1954). Specimens from the following herbaria have been consulted during the course of this study:

C.....Botanical Museum and Herbarium, University of Copenhagen.
CAS.....Herbarium of the California Academy of Sciences.
DAV.....Herbarium of the University of California, Davis.
DS.....Dudley Herbarium, Stanford University.
F.....Herbarium of the Chicago Natural History Museum.
GH.....Gray Herbarium, Harvard University.
K.....The Herbarium and Library, Royal Botanic Gardens, Kew.
KANU.....Herbarium of the University of Kansas.
KSC.....Herbarium of Kansas State College of Agriculture and Applied Science.
MEXU.....Herbario Nacional del Instituto de Biologia, Universidad Nacional de México.
MIN.....Herbarium of the University of Minnesota.
MO.....Herbarium of the Missouri Botanical Garden.
ND.....Herbarium of the University of Notre Dame, Indiana.
NEW MEX...Herbarium of the University of New Mexico (no standardized abbreviation assigned).
NY.....Herbarium of The New York Botanical Garden.
PH.....Herbarium of the Academy of Natural Sciences, Philadelphia.
POM.....Herbarium of Pomona College.
RM.....Rocky Mountain Herbarium, University of Wyoming.
RSA.....Herbarium of the Rancho Santa Ana Botanic Garden.
SMU.....Herbarium of Southern Methodist University.
TEX.....Herbarium of the University of Texas.
UC.....Herbarium of the University of California, Berkeley.
US.....Herbarium of the United States National Museum.

Systematic Treatment

Argemone L., Sp. Pl. 1: 508-509. 1753,

excluding *A. armeniaca* and *A. pyrenaica* (from the Greek αργεμα, the cataract of the eye for which the juice of a poppy-like plant of the same name was a supposed remedy); [Tournef., Elem., p. 204, t. 121. 1694; Inst. Rei Herb. 1: 239, 2: t. 121. 1700]; L., Gen. Pl., ed. 5, p. 225. 1754; Lamarck, Encycl. Meth. 1: 247. 1783; Gaertn., Fruct. et Sem. Pl. 1: 287, t. 60. 1788; Jussieu, Gen. Pl., p. 236. 1789; Lamarck, Planches 2: t. 452. 1797; Tornef., Elem., ed. aug. (Jolyclerc) 2: 12, 5: t. 121. 1797; Nutt., Gen. 2:9. 1818; DC., Reg. Veg. Syst. Nat. 2: 85. 1821; DC., Prodr. 1: 120. 1824; Bernh., in Linnaea 8: 461. 1833; Endl., Gen. Pl., p. 856. 1836-1840; Meisner, Pl. Vasc. Gen., pars prior, p. 7, pars altera, p. 9. 1836-1843; Gray, Gen. Pl. U. S. 1: 111, t. 47. 1849; Benth. & Hook., Gen. 1 (1): 52. 1862; Baillon, Hist. Pl. 3: 112-113, figs. 125-127. 1871; Prantl & Kündig, in Engler & Prantl, Nat. Pflanzenf. 3 (2): 141. 1889; Prain, in Journ. Bot. 33: 129. 1895; Gray, Syn. Fl. N. Am. 1 (1): 87-88. 1895; Rose, in Contrib. U. S. Nat. Herb. 8: 23-27. 1903; Fedde, in Engler, Pflanzenr. 4 (104): 271. 1909.

Ectrus Lour., Fl. Cochinch. 1: 344. 1790.

Enomegra Nels., Analyt. Key Fl. Pl. Rocky Mt. Reg., p. 27. 1902; Nels., in Bot. Gaz. 34: 365. 1902.

Annual or perennial herbs (one shrub) with a persistent or ephemeral tap root. Latex pale lemon-yellow, almost white, through various shades of yellow to bright golden yellow, orange, or reddish-orange. Stems glaucous, 1-10 (-25 or more), erect or ascending, 2-10 (-20) dm. tall, each axis determinate, essentially smooth to closely prickly. Leaves glaucous, apetiolate, those of the basal rosette and lower stem obovate to oblanceolate, the middle and upper cauline progressively elliptical or ovate, the upper ones often clasping, the ultimate foliar organs very much reduced and bracteate. Leaf margins always dentate, each tooth terminated by a prickle, the blade otherwise wholly unlobed or, commonly, shallowly to deeply lobed. Leaf surfaces essentially smooth to closely prickly, hispid, or crisped-hispid, the areas over the main veins often of a lighter

bluish cast and thereby contrasting with the deeper bluish coloration of the remaining intervein surfaces. Flower buds narrowly to broadly oblong, obovate, elliptical or subspherical. Sepals caducous, normally 3 (2-6), imbricated, essentially smooth to variously prickly and hispid, each with a subterminal horn. Sepal horns hollow and herbaceous basally, terminated by an indurated prickle, terete or variously angular or flattened in cross-section. Flowers 3-15 cm. in diameter when fully expanded, either closely subtended by or separated by 1-several mm. from the nearest foliar bract. Petals normally 6, in two whorls of 3, narrowly elliptical to obcuneate, obovate or suborbicular, the outer margin minutely erose, in color, of various shades of yellow, or golden, bronze, lavender, or white. Stamens about 20-250 or more per flower, and filaments filiform, rarely clavate, usually pale lemon-yellow, but occasionally red to lavender, the anthers linear, basifixed, 2-celled, with longitudinal, extrorse dehiscence, coiled after anthesis, bright yellow or occasionally purplish. Stigma 3-5 (-7) -lobed, the lobes concave, formed by a down-folding of the stigmatic surface opposite each placentum, the receptive surfaces felt-like, purple (rarely yellowish-green). Style essentially absent or quite evident on mature capsules. Ovary unilocular, 3-5 (-7) -carpellate, with an equal number of placentae. Capsules fluted on the sutures, the valves splitting away from the vascular elements apically and for about one-third their length along the sutures, the exposed portion of the vascular elements forming a cage-like framework which remains attached at the tip to the persistent stigma, in shape, the mature unopened capsules varying from oblong to elliptical, ovate, or lanceolate, in armature varying from totally glabrous to very closely spinescent. Ovules numerous. Seeds blackish-brown, subspherical, the longest dimension 1-3 mm., anatropous, apiculate at the micropyle, the raphe straight, prominent, more or less umbonate at the chalazal end, the testa conspicuously scrobiculate under magnification, the endosperm copious, the embryo minute, straight, embedded in the endosperm.

Type species: *A. mexicana* L. The pre-Linnaean history of this species is fully discussed by Prain (1895, p. 130).

Distribution: Coastal areas of southeastern and southern United States; in the west from southern Montana and western South Dakota southward across the plains to the Gulf of Mexico, southwestward to California, Arizona and New Mexico; throughout the West Indies, Mexico and Central America; in South America in Chile, Argentina, Uruguay, Paraguay, Bolivia and northward along the coasts to the Isthmus of Panama; Hawaii; *A. mexicana* by introduction in tropical and subtropical lands around the world.

Key to the species:

1. Petals pale lemon-yellow, bright yellow, sulphur-yellow, golden or bronze.
   2. Stems woody, perennial; petals pale yellow to sulphur-yellow; southern Coahuila ..... 1. *A. fruticosa*
2. Stems herbaceous, annual, the underground parts often perennial.
   3. Petals ordinarily white but sometimes with a yellowish cast.
      4. Sepal horns strongly flattened in a radial plane; flowers usually separated from the nearest subtending foliar bract by several mm.; stamens about 75; capsules elliptical to ovate-elliptic, the surface closely spinescent and prickly, the armature nearly or completely obscuring the capsular surface; Vera Cruz to Michoacán ..... 15. *A. platyceras*
      4. Sepal horns usually angular, sometimes flattened, but not as above; flowers usually more closely subtended by 1-2 foliar bracts; stamens 80-120 or more; capsules oblong-elliptic to lanceolate, the surface thinly to rather closely spi-

nescent and prickly, the capsular surface clearly visible to partly obscured by the armature; southern Chihuahua to San Luis Potosí ..... 16. *A. arida*

3. Petals distinctly pale to bright yellow; capsules smooth or armed with large, well-spaced spines, these sometimes interspersed with a few smaller spines and prickles.
5. Stamens about 20-75; flowers 3-7 cm. broad when fully expanded; petals pale lemon-yellow to bright yellow.
6. Capsular surfaces smooth (f. *leiocarpa*) or spinescent; capsules oblong to broadly elliptical; buds subspherical; petals mostly bright yellow; stigmatic lobes appressed to the style at anthesis; West Indies and adjacent continental areas ..... 2. *A. mexicana*
6. Capsular surface spinescent; capsules lanceolate, ovate-lanceolate or occasionally oblong-elliptic; buds oblong; petals mostly lemon-yellow; stigmatic lobes spreading, not appressed to the style at anthesis; Mexico outside the tropical areas ..... 3. *A. ochroleuca*
5. Stamens about 150-250; flowers 7-12 cm. broad when fully expanded; petals bright yellow to golden or bronze.
7. Petals bright yellow; filaments lemon-yellow; stigma at anthesis about 2.5-3.0 mm. broad, the lobes barely sinuate; southern San Luis Potosí ..... 4. *A. superba*
7. Petals bright yellow to golden or bronze; filaments red or purplish; stigma at anthesis 3-6 mm. broad, the lobes usually distinctly sinuate; northeastern Mexico and adjacent Texas ..... 5. *A. aenea*

1. Petals white or of some shade of lavender.
8. Petals of some shade of lavender.
9. Uppermost leaves not clasping; lower leaves lobed to four-fifths of the distance to the midrib or more.
10. Stems often closely prickly; capsules narrowly elliptic-lanceolate or elliptic-ovate; longest dimension of seeds 1.8-2.2 mm.; western Texas ..... 18. *A. chisosensis*
10. Stems not closely prickly; capsules narrowly to broadly elliptical; longest dimension of seeds about 1.5 mm.; southern Texas and northeastern Mexico ..... 17. *A. sanguinea*
9. Uppermost leaves clasping; lower leaves lobed to less than two-thirds the distance to the midrib; Great Plains ..... 22. *A. polyanthemos*
8. Petals white.
11. Petals narrowly elliptical, 5-8 mm. broad, 15-25 mm. long; stamens 20-30; northern Durango and southern Chihuahua ..... 3b. *A. ochroleuca* subsp. *stenopetala*
11. Petals suborbicular to obovate or obcuneate, mostly 30-60 mm. long; stamens about 75-150 or more; cosmopolitan.
12. Leaf surfaces prickly on the primary and secondary veins above and below and also minutely hispid or prickly, often closely so, between the veins; stems usually closely prickly.
13. Largest capsular spines compound, i.e., with few to many smaller spines or prickles arising from the basal portion, usually 8-35 mm. long.
14. Largest capsular spines about 15-35 mm. long; latex reddish-orange when fresh; Texas ..... 6. *A. aurantiaca*
14. Largest capsular spines about 8-15 mm. long; latex pale lemon-yellow to yellow when fresh.
15. Lower cauline leaves lobed to about three-fourths the distance to the midrib, the apices of the lobes angular, the marginal teeth usually 3 mm. long or longer, not including the terminal prickle; flowers usually closely subtended by 1-2 foliar bracts.
16. Body of buds 8-10 mm. broad by 14-18 mm. long; sepal horns terete;

stamens about 100; northeastern Mexico ..... 7. *A. echinata*

16. Body of buds 15-20 mm. broad by 16-25 mm. long; sepal horns angular in cross-section; stamens 150 or more; western Kansas to New Mexico and western Texas ..... 8. *A. squarrosa*

15. Lower cauline leaves lobed to about one-half the distance to the midrib, the apices of the lobes usually definitely rounded, the marginal teeth usually less than 1 mm. long, not including the terminal prickle; flowers usually separated by an interval of several mm. from the nearest subtending foliar bract; western United States ..... 10e. *A. munita* subsp. *rotundata*

13. Largest capsular spines simple, usually 5-8 mm. long.

17. Lower cauline leaves lobed to three-fourths the distance to the midrib or or more; uppermost leaves not clasping the stem.

18. Leaf surfaces between the main veins densely and minutely crisped-hispid; sepal horns angular in cross-section; capsules ovate, closely spinescent, the armature completely or nearly completely obscuring the capsular surface, the largest spines about 5 mm. long; eastern base of the Rocky Mts., Wyoming to New Mexico ..... 9. *A. hispida*

18. Leaf surfaces between the main veins variously prickly but not densely or minutely crisped-hispid; sepal horns terete.

19. Capsules oblong to elliptical, armed with long, spreading spines intermixed with smaller spines and prickles, the surface greatly obscured, the largest spines 9-11 mm. long; sepal horns about 10 mm. long; stamens about 100; northeastern Mexico ..... 7. *A. echinata*

19. Capsules narrowly elliptic-lanceolate, armed with uneven-sized spines and prickles, the capsular surface clearly visible, the largest spines 5-6 mm. long; sepal horns 3-5 mm. long; stamens about 150 or more; southern Chihuahua ..... 12. *A. brevicornuta*

17. Lower cauline leaves lobed to one-half the distance to the midrib or less; uppermost leaves usually definitely clasping the stem.

20. None of the leaves lobed, the margins sometimes undulate, irregularly toothed; flowers closely subtended by 2-4 foliar bracts; longest dimension of seeds about 1 mm.; northern Baja California ..... 11. *A. subintegrifolia*

20. Lower cauline leaves usually lobed to about one-half of the distance to the midrib, the lobes usually apically rounded, toothed; flowers usually separated by several mm. from the nearest subtending foliar bract; longest dimension of seeds 1.8-2.6 mm.; western United States ..... 10. *A. munita* subspp.

12. Leaf surfaces prickly almost exclusively on the primary and secondary veins above and below, sometimes essentially smooth; stems usually with more widely spaced prickles or almost smooth.

21. Largest capsular spines compound, i.e., with few to many smaller spines or prickles arising from the basal portion, usually 8-35 mm. long.

22. Largest capsular spines 15-35 mm. long, always definitely compound; latex reddish-orange when fresh; Texas ..... 6. *A. aurantiaca*

22. Largest capsular spines 8-15 mm. long, sometimes not clearly compound; latex pale lemon-yellow to yellow when fresh; western Texas and southeastern New Mexico ..... 8b. *A. squarrosa* subsp. *glabrata*

21. Largest capsular spines simple, 4-10 (-12) mm. long.

23. Prickles of sepals and, when present, those of the sepal horns perpendicular; lower cauline leaves mostly lobed to four-fifths or more of the distance to the midrib.

24. Uppermost leaves usually definitely clasping; lower cauline leaves lobed to less than one-half, or sometimes to about three-fourths, of the distance to the midrib.

25. Lower cauline leaves lobed to about three-fourths of the distance to the midrib, the apical margins of the lobes angular, i.e., the marginal teeth prominent; latex bright yellow when fresh; central Arizona ..... 14c. *A. pleiacantha* subsp. *ambigua*

25. Lower cauline leaves lobed to one-half the distance to the midrib or less, the apical margins of the lobes tending to be rounded, i.e., the marginal teeth very short; latex pale lemon-yellow when fresh; southern California to Baja California ..... 10. *A. munita* subspp.

24. Uppermost leaves not definitely clasping; lower cauline leaves lobed to four-fifths of the distance to the midrib or more.

26. Buds subspherical; sepal horns terete, 3-5 mm. long; capsules narrowly elliptic-lanceolate, 8-10 mm. broad exclusive of armature; latex bright yellow when fresh; southern Chihuahua ..... 12. *A. brevicornuta*

26. Buds oblong to obovate or elliptical, rarely subspherical; sepal horns terete or flattened or angular in cross-section, 5-14 mm. long; capsules ovate to elliptical or elliptic-oblong, rarely elliptic-lanceolate, 8-18 mm. broad exclusive of armature; latex pale lemon-yellow to bright yellow when fresh.

27. Buds usually subspherical; sepal horns terete, usually slender, 8-12 (5-14) mm. long, smooth; stems armed with usually very long, scattered, perpendicular prickles; latex usually pale lemon-yellow when fresh; western Arizona, Sonora and Baja California del Sur ..... 20. *A. gracilenta*

27. Buds oblong to obovate or elliptical, rarely subspherical; sepal horns terete or flattened or angular in cross-section, various in length, nearly always prickly; stems sparsely to closely prickly; latex pale lemon-yellow to bright yellow when fresh.

28. Stems copiously long-prickly, often decumbent, diffusely branched; leaves deeply and distantly lobed to near the midrib, the narrow lobes often 5 or more times as long as broad; sepal horns terete, 12-15 mm. long; capsules 3-carpellate, narrowly elliptic-oblong, closely spinescent, the largest spines 8-10 mm. long; latex pale lemon-yellow when fresh; Grand Canyon, Arizona ..... 13. *A. arizonica*

28. Stems sparsely to copiously prickly, erect, not diffusely branched; leaves often deeply lobed, but the lobes seldom so long in proportion to their breadth as above; sepal horns terete or flattened or angular in cross-section, 5-12 mm. long; capsules 3-4 (-6) carpellate, elliptical to ovate or lanceolate, variously spinescent, the longest spines 4-8 (-10) mm. long; latex usually bright yellow when fresh.

29. Buds broadly elliptical to elliptic-oblong; sepal horns terete or angular in cross-section; petals white or some shade of lavender; capsules 3-6-carpellate, armed with larger spines intermixed with smaller spines and prickles, the largest spines 5-10 mm. long, the capsular surface clearly visible through the armature.

30. Stems often closely prickly; capsules narrowly elliptic-ovate; longest dimension of seeds 1.8-2.2 mm.; western Texas ..... 18. *A. chisosensis*

30. Stems not closely prickly; capsules narrowly to broadly elliptical; longest dimension of seeds about 1.5 mm.; southern Texas to northeastern Mexico ..... 17. *A. sanguinea*

29. Buds usually obovate, rarely subspherical or oblong-obovate; sepal horns usually flattened on the adaxial side, rarely terete; petals white; capsules 3-4-carpellate, either densely spinescent

with uneven-sized spines and prickles, the capsular surface much obscured by the armature, or to rather sparsely armed with more even-sized spines, the capsular surface clearly visible through the armature; southwestern New Mexico to Arizona and adjacent Mexico ..... 14. *A. pleiacantha*

23. Prickles of sepals and sepal horns (when present) ascending, or sepals smooth; lower cauline leaves often lobed to less than one-half the distance to the midrib.
  31. Sepal horns strongly flattened in a radial plane; stamens about 75, the filaments pale lemon-yellow to reddish-lavender; capsules closely spinescent and prickly, the armature nearly or completely obscurng the capsular surface; Vera Cruz to Michoacán ..... 15. *A. platyceras*
  31. Sepal horns not flattened as above; stamens more numerous, the filaments pale lemon-yellow, very rarely reddish-lavender; capsular surface clearly visible through the armature, or rarely partially obscured.
    32. Stems moderately to rather closely prickly; sepal horns slightly to very definitely prickly.
      33. Lower cauline leaves lobed to one-half to three-fourths the distance to the midrib; buds oblong; sepal horns more or less angular or flattened, 7-10 (-12) mm. long; stamens usually 80-120, the filaments pale lemon-yellow to reddish-lavender; largest capsular spines about 8 mm. long, the capsular surface sometimes partially obscured by the armature; southern Chihuahua to San Luis Potosí ..... 16. *A. arida*
      33. Lower cauline leaves lobed to about four-fifths the distance to the midrib; buds subspherical; sepal horns terete, 3-5 mm. long; stamens about 150 or more, the filaments pale lemon-yellow; largest capsular spines 5-6 mm. long, the capsular surface clearly visible through the armature; southern Chihuahua ..... 12. *A. brevicornuta*
    32. Stems with scattered, sometimes long prickles to essentially smooth; sepal horns smooth or very rarely with 1-few prickles near the base.
      34. Leaves thick and coriaceous, shallowly lobed (subsp. *corymbosa*), or the lower ones deeply lobed to four-fifths of the distance to the midrib (subsp. *arenicola*); stamens usually 100-120; stigma yellowish-green or purplish; latex orange when fresh; Mohave Desert, California, and southeastern Utah to adjacent Arizona ..... 19. *A. corymbosa* subspp.
      34. Leaves often succulent, but not coriaceous, variously lobed; stamens about 150 or more; stigma purple; latex pale lemon-yellow to bright yellow when fresh.
        35. Buds obovate or oblong; sepal horns usually flattened on the adaxial side, sometimes prickly.
          36. Buds obovate; sepal horns prickly; lower cauline leaves lobed to about three-fourths the distance to the midrib, the apical margins of the lobes angular, i.e., the marginal teeth prominent; latex bright yellow when fresh; central Arizona ..... 14c. *A. pleiacantha* subsp. *ambigua*
          36. Buds oblong; sepal horns smooth; lower cauline leaves lobed to about one-half the distance to the midrib or less, the apical margins of the lobes tending to be rounded, i.e., the marginal teeth very short; latex pale lemon-yellow when fresh; Orange Co., California ..... 10a. *A. munita* subsp. *robusta*
        35. Buds usually subspherical, rarely elliptical or elliptic-oblong; sepal horns terete, seldom with 1-few prickles near the base.
          37. Uppermost cauline leaves not evidently clasping; sepal horns 8-12 (5-14) mm. long; stems armed with usually very long,

scattered, perpendicular prickles; latex usually pale lemon-yellow when fresh; western Arizona, Sonora and Baja California del Sur ..... 20. *A. gracilenta*

37. Broad bases of the uppermost cauline leaves clasping; sepal horns of various lengths; stems essentially smooth to prickly with scattered, shorter prickles; latex bright yellow when fresh.
38. Stems smooth or with a very few widely scattered prickles; leaves entirely smooth on both surfaces or with a very few prickles on the veins beneath and also rarely above; buds subspherical, almost invariably totally smooth; sepal horns 7-15 mm. long; capsules broadly oblong-elliptic, with a few stout, subequal spines, the largest of which are about 5 mm. long; Hidalgo to southern Tamaulipas ..... 21a. *A. grandiflora* subsp. *grandiflora*

38. Stems definitely prickly throughout; leaves with scattered prickles on the main veins beneath, totally smooth or with a few scattered prickles on the main veins above; buds subspherical to elliptical, with scattered or rather close-set prickles; sepal horns variable; capsules variable, the largest spines 6-12 mm. long.
39. Sepal horns 7-15 mm. long.
40. Lower cauline leaves divided to about three-fourths the distance to the midrib; uppermost leaves not conspicuously clasping; buds subsperical; capsules oblong to elliptical; southern Tamaulipas to southern Coahuila ..... 21b. *A. grandiflora* subsp. *armata*

40. Lower cauline leaves divided to about two-thirds the distance to the midrib; uppermost leaves usually very broad basally and definitely clasping; buds elliptic-oblong; capsules narrowly to broadly elliptical; Great Plains ..... 22. *A. polyanthemos*

39. Sepal horns usually 3-6 mm. long.
41. Lower cauline leaves divided to about two-thirds the distance to the midrib; buds subspherical; sepal horns 3-5 mm. long; capsules 3-7-carpellate, oblong to oblong-elliptic, the spines all rather stout, even-sized and widely-spaced; coastal areas; North Carolina to Mississippi and introduced northward ..... 23a. *A. albiflora* subsp. *albiflora*

41. Lower cauline leaves divided to about four-fifths the distance to the midrib; buds subsperical to broadly elliptical; sepal horns 4-6 (rarely -10) mm. long; capsules 3-5-carpellate, narrowly elliptical, the widely spaced large spines interspersed with uneven-sized smaller spines and prickles; eastern Texas and introduced to the northeast ..... 23b. *A. albiflora* subsp. *texana*

1. ARGEMONE FRUTICOSA Thurber ex Gray, in Mem. Am. Acad., n.s., 5: 306. 1853.

A. fruticosa Mueller, in Walp., Ann. 4: 170. 1857; Hemsl., Biol. Cent. Am., Bot. 1: 26. 1879; Wats., in Proc. Am. Acad. 17: 318. 1882; Hemsl., Biol. Cent. Am., Bot. 4: 4. 1886; Prain, in Journ. Bot. 33: 307. 1895; Gray, Syn. Fl. N. Am. 1 (1): 87. 1895; Rose, in Contr. U. S. Nat. Herb. 8: 24. 1903; Fedde, in Pflanzenr. 4 (104): 273, 274, fig. 36A. 1909.

Perennial shrub, the latex color unknown; stems 5-20 dm. tall, ligneous, divergently

and rigidly branched, the older portions bare of foliage, beset with persistent leaf bases forming stumps to 1 mm. or more in length, the younger portions of the stem very glaucous and often with a few scattered prickles, densely leafy; leaves thick and coriaceous, very glaucous, mostly 1.5-3.5 cm. long, oblong, each of the large acute marginal teeth terminated by a long, rigid spine, the leaf surfaces entirely smooth or with 1-3 small prickles on the veins, the veins very inconspicuous; buds subspherical, the body about 11-13 mm. broad, 13-15 mm. long, smooth or with 1-3 prickles on each sepal, the horns terete in cross-section, 8-14 mm. long including the stout terminal spine, smooth; flowers 5-10 cm. in diameter, closely subtended by 1-several little if at all reduced leaves; petals pale yellow to sulphur-yellow, broadly obovate-obcuneate; stamens numerous; stigma purple, about 2 mm. wide and 2.0-2.5 mm. high, the lobes tightly compressed to each other at flowering time, expanding and spreading apart as the ovary develops; capsules 4-6-carpellate, very broadly ovate, the width, exclusive of armature, 10-15 mm., the length, including the stigma, 14-22 mm., even-spinescent, the largest spines to about 6 mm. long, the swollen-tuberculate bases of the spines obscuring the capsular surface, the surface also sparingly prickly among the tubercles; seeds 2.0-2.2 mm. long. (Ill.: Fig. 1, 1-4; Dist.: Fig. 5.)

Lectotype: *Thurber* 844, collected at "Mountain Pass, La Peña" Coahuila, Mexico, 1852 (GH; isotypes, MO, NY). Gray, l.c., quoting Thurber says " . . . met with only in the mountain pass of La Peña, near the town of Parras." The settlement of Peña is situated on the railroad about 30 miles west of Parras. Thurber's collection is in fruit only, and is most fragmentary.

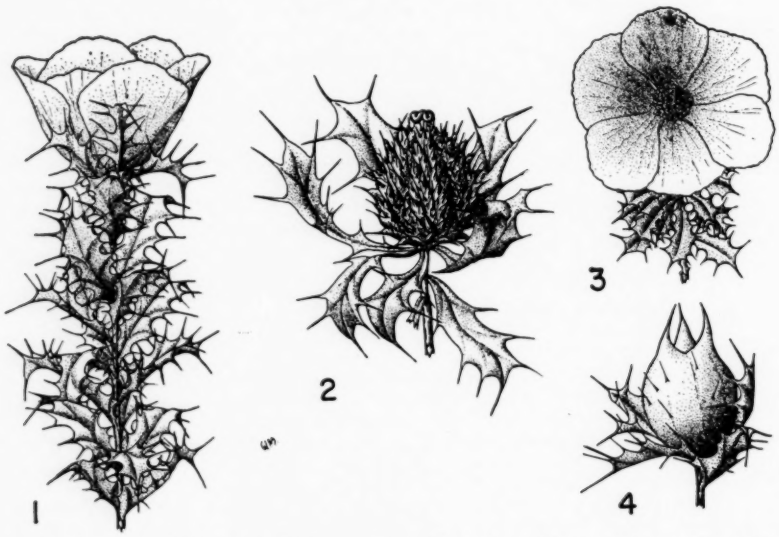

FIG. 1. *A. fruticosa.* 1. Flowering branch × ½. *Hinton et al.* 16582 (US). 2. Capsule × 1. *Palmer* 21 (GH). 3. Open flower × ½. Same as 2. 4. Bud × 1. Same as 2.

Habitat and distribution: Rocky slopes, hills and canyons, southern Coahuila in the mountains near Parras, at elevations of probably 5500 to 6000 ft.

Flowering and fruiting dates: Evidently flowers from May 1 onward through the summer; fruits mature a month or more after flowering.

A. fruticosa is not closely allied to any other species. It is distinctive in its shrubby habit, coriaceous leaves which Prain rightly described as holly-like, its persistent leaf bases, and its tuberculate-spinescent, broadly ovate capsules as well as in many other characters. Prain, l.c., describes the capsules as dehiscing nearly to the base, a character I have not been able to observe in the material before me. If true, this is another important distinguishing feature of the species as all of the others dehisce only in the upper portion. This is only a matter of degree, however, and this character, if verified, constitutes no more than an additional specific distinction. The morphological features setting *A. fruticosa* apart are not sufficient, in the writer's opinion, to justify removing the species from the genus.

This species is a local endemic and, although it has been known for over 100 years, adequate collections have never been distributed. New and ample collections made at various times of year would doubtless be of material value in gaining a more complete knowledge of the species. *A. fruticosa* and *A. subintegrifolia* are the only North American species of *Argemone* that the writer has not personally studied in the field.

Specimens examined: MEXICO.

COAHUILA

S. Lorenzo de Laguna, 7 miles s.w. from Parras, *Palmer* 21 (GH, US); San Lorenzo de Laguna and vicinity, 22 to 27 leagues s.w. from Parras, *Palmer* 1064 (US); Villareal, *Purpus* 4646 (F, MO, UC); S. Paila (Valle Yucatán), alt. 1700 m., *Hinton et al.* 16582 (GH, US); mountain pass, La Peña, *Thurber* 844 (GH, lectotype of *A. fruticosa* Thurber ex Gray; isotypes, MO, N.Y).

2. ARGEMONE MEXICANA L., Sp. Pl. 1: 508. 1753.

A. mexicana [Tournef., Élémens de Bot., p. 204, t. 121. 1694; Tournef., Inst. Rei Herb., 1: 239, 2: t. 121. 1700]; L., Syst. Nat., ed. 10, 2: 1073. 1759; Miller, Gard. Dict., ed. 7. 1759; Miller, Figures 1: 33, t. 50. 1759; Lamarck, Encycl. Méth. 1: 247. 1783; Gaertn., Fruct. et Sem. Pl. 1: 287; t. 60. 1788; Walter, Fl. Carol., p. 153. 1788; Aiton, Hort. Kew., ed. 1, 2: 225. 1789; Vitm., Summa Pl. 3: 297. 1789; Curtis, Bot. Mag. 7: t. 243. 1794; Lamarck, Planches 2: t. 452. 1797; Lestib., Bot. Belg. ed. 2, pt. 3, 2: 131. 1799; Willd., Sp. Pl. 2: 1148. 1799; Pers., Syn. Pl. 2: 62. 1807; Aiton, Hort. Kew., ed. 2, 3: 290. 1811; Lunan, Hort. Jamaic. 2: 312. 1814; Pursh, Fl. Am. Sept. 2: 366. 1814, excluding white-flowered variety; Hornem., Hort. Hafn., p. 489. 1815; Nutt., Gen. 2: 9. 1818, excluding white-flowered species; DC., Reg. Veg. Syst. Nat. 2: 85. 1821; DC., Prodr. 1: 120. 1824; Elliott, Bot. Carol. & Georg. 2: 13. 1824, excluding white-flowered variety; Spreng., Syst. Veg., ed. 16, 2: 604. 1825, excluding *A. alba* Raf., in synonomy; Darlingt., Fl. Cest., p. 57. 1826; Loud., Hort. Brit., p. 216. 1830; Roxb., Fl. Ind. 2: 571. 1832; Beck, Botany, p. 21. 1833, in part; Hook., in

Journ. Bot. 1: 190. 1834, as to Drummond 15; Wight & Arn., Prodr. 1: 18. 1834; Blanco, Fl. de Filip., p. 454. 1837; Torrey & Gray, Fl. N. Am. 1: 61. 1838, excluding varieties β, γ, and white-flowered forms in references cited; Wight, Ill. Ind. Bot. 1: t. 11. 1840; Walp., Rep. 1: 109. 1842, excluding varieties; Gray, Man., ed. 1, p. 26. 1848, excluding white-flowered component; Gray, Gen. 1: 111, t. 47. 1849; Walp., Ann. 2: 26. 1852, in part; Seemann, Bot. Voy. H.M.S. Herald, pp. 23, in part, 78, 363. 1852-1857; Darlingt., Fl. Cest., ed. 3, p. 13. 1853; Hook. f. & Thoms., Fl. Ind. 1: 251. 1855; Mueller, in Walp., Ann. 4: 170. 1857, in large part; Chapm., Fl. So. U. S., p. 21. 1860, excluding white-flowered plants; Griseb., Fl. Br. W. Ind., p. 13. 1864; Oliv., Fl. Trop. Afr. 1: 54. 1868; Hook. f. & Thoms., in Hook., Fl. Br. Ind. 1: 117. 1872; Baker, Fl. Maurit., p. 5. 1877; Blanco, Fl. Filip., Gran. ed., 2: 220. 1878; Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879, in part; Fern.-Vill., Nov. App., in Blanco, Fl. Philip., 4(3): 9. 1880; Hemsl., Biol. Cent. Am., Bot. 4: 97. 1887; Hemsl., l.c., p. 111; Balf., Bot. Socotra, in Trans. Royal Soc. Edinb. 31: 3. 1888; Prantl & Kündig, in Engl. & Prantl, Nat. Pflanzenf. 3 (2): 135, 141. 1889, excluding fig. 83B; Coulter, in Contr. U. S. Nat. Herb. 2: 12. 1891; Kuntze, Rev. Gen. 1: 12. 1891; Gray, Syn. Fl. N. Am. 1 (1): 87. 1895; Britton & Brown, Ill. Fl. 2: 101. 1897; Chapm., Fl. So. U. S., ed. 3, p. 20. 1897, as to yellow-flowered plants; Urbina, Cat. Pl. Mex., p. 5. 1897, as to name only, not as to cited specimens; Smith, in Pittier, Primit. Fl. Costar. 2: 18. 1898; Mohr, Pl. Alab., in Contr. U. S. Nat. Herb. 6: 520. 1901; Britton, Man., p. 439. 1901; Rose, in Contr. U. S. Nat. Herb. 8: 24. 1903; Small, Fl. s.e. U. S., p. 462. 1903; Urban, Sym. Ant. 4:250. 1905; Rydb., Fl. Colo., p. 149. 1906; Robins. & Fern., in Gray's Man., ed. 7, p. 416. 1908, excluding var. *ochroleuca;* Fedde, in Pflanzenr. 4 (104): 273, 274, fig. 36B. 1909, excluding *Pringle* 8321; Boldingh, Fl. Ned. W. I., p. 194. 1913; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913; Small, Fl. Flor. Keys, p. 52. 1913; Fawc. & Rendl., Fl. Jamaica 3: 221. 1914; Rydb., Fl. R. Mts., p. 317. 1917; Britton, Fl. Berm., p. 144. 1918; Urban, Sym. Ant. 8: 236. 1920; Britton & Millsp., Bahama Fl., p. 145. 1920; Rydb., Fl. Pr. & Pl., p. 353. 1932; Small, Man. S. E. Fl., p. 548. 1933; Stahl, Fl. Puerto Rico, ed. 2, 1: 80. 1936; Stehlé et al., Fl. Guad. 2 (1): 32. 1937; Stemen & Myers, Okla. Fl., p. 162. 1937; Gates, Fl. Kans., p. 156. 1940; Moscoso, Cat. Fl. Dom., p. 204. 1943; Standl. & Steyerm., Fl. Guat., Fieldiana: Botany 24 (4): 348. 1946, in part; Stevens, Kans. Wild Fl., p. 116. 1948; Fernald, Gray's Man., ed. 8, p. 681. 1950; Gleason, New Ill. Fl. 2: 199. 1952; Harringt., Man. Pl. Colo., p. 252. 1954; Jones & Fuller, Vasc. Pl. Ill., p. 221. 1955.

Papaver spinosum [Bauhin, Phytopinax, p. 311. 1596; Bauhin, Pinax, p. 171. 1623].

Carduus Chrysanthemus Peruanus [Gerard, Herbal, p. 993. 1597].

Ectrus trivialis Lour., Fl. Cochinch. 1: 344. 1790; Steudel, Nomencl. Bot., ed. 2, 1: 543. 1840 (misspelled *trivalvis*).

Argemone spinosa Moench, Meth. Pl., p. 227. 1794; Sheeut, Fl. Carol. 1: 202. 1806.

A. versicolor Salisb., Prod. Stirp., p. 376. 1796.

L'Argemone du Mexique Tourn., Élém. Bot., éd. aug., 2: 12, 5: t. 121. 1797.

Argemone sexvalis Stokes, Bot. Mat. Med. 3: 195. 1812.

A. vulgaris α Spach, Hist. Nat. Veg. 7: 26. 1839.

A. mucronata Dum. Cours. ex Steudel, Nomencl. Bot., ed. 2, 1: 128. 1840.

A. mexicana α *lutea* Kuntze, Rev. Gen. 1: 12. 1891.

A. mexicana α *lutea* var. *parviflora* Kuntze, l.c.

A. mexicana var. *typica* Prain, in Journ. Bot. 33: 308. 1895.

A. mexicana var. *ochroleuca* Britton, Man., p. 439. 1901; not *A. ochroleuca* Sweet.

Ectrus mexicanus Nieuwland, in Am. Midl. Nat. 3: 350. 1914.

Annual with bright yellow latex; stems mostly 1, 2.5-8.0 (-10.0) dm. tall, often branched from near the base, smooth (in f. *leiocarpa*) or rather sparingly prickly with perpendicular or slightly reflexed prickles; leaves glaucous, the light blue markings over the veins conspicuous, oblanceolate below, progressively broadly elliptical to ovate above, the middle and upper ones mostly very evidently clasping the stem, the lamina lobed to one-half or more of the distance to the midrib in the lower leaves, more shallowly lobed upward, the lobes oblong, the sinuses comparatively narrow, the acute mar-

ginal teeth tipped with a slender spine, both lower and upper surfaces of the leaves totally smooth (in f. *leiocarpa*) or the lower surfaces sparingly prickly on the main veins, the upper surfaces very distantly prickly on the main veins or totally smooth; buds subspherical or barely oblong, the body 9-13 mm. broad, 10-15 mm. long, totally smooth (in f. *leiocarpa*) or very sparingly prickly, the sepal horns terete, 5-10 mm. long including the apical spine, smooth; flowers 4-6 (-7) cm. in diameter, closely subtended by 1 or 2 foliar bracts; petals bright yellow or evidently sometimes pale yellow, the outer obovate, the inner obovate to obcuneate; stamens 30-50, the filaments pale lemon-yellow, the anthers yellow; stigma purple, about 1.5-4.0 mm. wide by 1.0-2.0 mm. high, the lobes pressed against each other and appressed to the style at anthesis, the non-receptive tissue between the lobes usually not visible in living state at this stage; style to about 1.0 (-3.0) mm. long in fruit; capsules 4-6-carpellate, oblong to broadly elliptical, the width, excluding the spines if present, 12-20 mm., the length, including the stigma and style, 25-45 mm., the surface totally smooth (in f. *leiocarpa*) or spinescent, then the armature consisting mostly of large, rather even-sized spines, the longest of which is about 6-10 mm., a very few lesser spines or prickles sometimes present, the capsular surface clearly visible through the armature; seeds 1.6-2.0 mm. long. (Ill.: Fig. 2, 1-3; Dist.: Fig. 5.)

Holotype: The specimen of *Argemone* in the Linnaean Herbarium marked by Linnaeus himself as *Argemone mexicana* (not seen; photographs, F, GH, US). See B. D. Jackson (1907, 1912) and Savage (1945).

Habitat and distribution: Waste places, often a weed along roadways and in dooryards and fields; doubtless native to the West Indies and probably also native in parts of Central America and Florida, but probably entirely introduced in Mexico except on the Yucatan Peninsula; now cosmopolitan in distribution through introduction into all tropical and subtropical parts of the world. In eastern United States the species is frequently introduced and is persistent for indefinite periods; probably it is not fully naturalized except in Florida and in coastal areas of the southern and southeastern states. In the distributional range herein considered, *A. mexicana* occurs at elevations of near sea level, generally, to 5000 ft. or more in Central America.

Flowering and fruiting dates: Flowers and fruits as local conditions permit at any time of the year.

Argemone mexicana was first described by Bauhin (1596) under the name *Papaver spinosum*. A year later Gerard (1597) described the same species under the name *Carduus chrysanthemus peruanus*. Tournefort (1694) first named the species *Argemone mexicana*. For taxonomic purposes, the use of the name derives from its acceptance by Linnaeus (1753).

Several post-Linnaean authors have proposed new names for *A. mexicana*. *A. spinosa* Moench represents an attempt to revive the oldest specific epithet for this species. *A. versicolor* Salisb. was a substitute name, evidently proposed because the author thought the current name inappropriate. *A. sexvalvis* Stokes was proposed to include those plants of *A. mexicana* with six valves or placentae in each capsule, a wholly superficial criterion since the number of valves is variable even on a single plant. *A.*

FIG. 2. 1-3. *A. mexicana*. 1. Bud × 1. From living plants, cult., Univ. of Minn. 2. Capsule × 1. Same as 1. 3. Habit × 1. Same as 1. 4. *A. mexicana* f. *leiocarpa*. Capsule × 1. *Curtis* 5653, *in part* (MIN).

vulgaris Spach is a composite species including three elements. The first element, his var. α is equivalent to *A. mexicana* L. *A. mucronata* Dumont de Courset is merely a listing of the name by Steudel and one has only Steudel's word that it is referable to *A. mexicana*. Kuntze's *A. mexicana* α *lutea* probably is intended to include all of the yellow-flowered argemones. Certainly his var. *parviflora* of α *lutea* is not separable from typical *A. mexicana*. *Ectrus trivialis* was proposed through lack of knowledge of the nomenclatorial history of the species.

The identity of *A. mexicana* is fully established by means of the holotype in the Linnaean Herbarium. I have seen a photograph of the holotype taken by the Linnaean Society in 1942. The plant shown is undoubtedly of Antillean stock.

The species is readily distinguished by its usually bright yellow petals, low stamen number and typically clasping, comparatively shallowly lobed middle and upper cauline leaves. It is most often confused with *A. ochroleuca* subsp. *ochroleuca*. The ways by which these two taxa can be distinguished are discussed under the latter species. *A. ochroleuca* Sweet has often been treated as a variety of *A. mexicana*. In my opinion the two should not be united.

Plants of *A. mexicana* with pale yellow flowers (sometimes said to be white; see Standley & Steyermark, 1946) have been collected in Costa Rica, El Salvador, Nicaragua, and Guatemala. The overall aspect of many of these plants also differs from that typical of the species as it occurs in the West Indies. The difference, if real, may be defined as a tendency toward narrower, more deeply lobed leaves, the marginal teeth more acute and with longer terminal spines. I place these aberrant Central American specimens in *A. mexicana* proper with reservations.

A. mexicana is one of those remarkable weeds which has spread throughout the world in tropical and subtropical regions in post-Columbian times. It is a common weed around seaport towns and it has been supposed that this has promoted the incidental transport of seeds along the seaways to similar localities in other parts of the world from which it has subsequently spread. Another feature of *A. mexicana* previously unreported is the high degree of self-compatibility of the individual plants. This means that a single viable seed may lead to the establishment of the species in a new locality. The seeds themselves retain their viability for at least several, perhaps many years.

Specimens examined: UNITED STATES.

ALABAMA

Mobile Co.: banks, Mobile river, *Mohr s.n.* (US).

CONNECTICUT

New Haven Co.: New Haven, *Kleeberger s.n.* (CAS).

FLORIDA

Collier Co.: Marco, *Standley* 12737 (US). Columbia Co.: Lake City, *Rolfs* 1075 (F). Dade Co.: Brickell Hammock, Miami, *Moldenke* 523 (MO, NY, US); Addison Hammock, *Small* 7481 (GH, NY, US). Duval Co.: Jacksonville, *Churchill s.n.* (GH, MO). Escambia Co.: Pensacola, *Tracy s.n.* (MO, NY). Franklin Co.: Apalachicola, *Chapman s.n.* (NY). Hillsborough Co.: Tampa, *Barnhart* 2234 (F, NY). Jefferson Co.: Monticello, *Lighthipe s.n.* (F). Lee Co.: Fort Myers, *Standley* 13033 (US). Monroe Co.: Key West, *Curtiss* 5653, *in part* (F, GH, KSC, MIN, MO, NY, POM, UC, US); Key West, *Pollard, Collins & Morris* 1 (F, MIN, ND, NY, US); Key West, *Rugel* 15 (NY). Polk Co.: Lakeland, *McFarlin* 4407 (CAS). St. Johns Co.: moat of Ft. San Marco, St. Augustine, *Smith s.n.* (US). Volusia Co.: New Smyrna, *Burgess* 574 (F. NY).

GEORGIA

Glynn Co.: Brunswick, *Small s.n.* (F, NY). McIntosh Co.: Darien, *Smith* 2123 (F).

ILLINOIS

Menard Co.: Athens, *Hall s.n.* (F). Stephenson Co.: Freeport, *Johnson s.n.* (NY, US).

KANSAS

Douglas Co.: no locality, *Snow* 114 (KANU).

LOUISIANA

Orleans Parish: New Orleans, *Drummond* 15 (GH). Plaquemines Parish: the Mississippi delta and adjacent islands, Port Eads, *Lloyd & Tracy* 294 (NY).

MARYLAND

Prince Georges Co.: Bladensburg, *Leonard* 17568 (US).

MASSACHUSETTS

Hampshire Co.: South Hadley, *Cook s.n.* (US). Middlesex Co.: Cambridge, *Morong s.n.* (NY).

MISSISSIPPI

Adams Co.: Natchez, *Shimek s.n.* (F).

MISSOURI

Franklin Co.: Pacific, *Kellogg* 1754 (MO). St. Louis, City, *Kellog s.n.* (US). Wayne Co.: Piedmont, *Trelease s.n.* (MO).

NEBRASKA

Sarpy Co.: Bellevue, *Hayden s.n.* (MO).

NEW JERSEY

Cape May Co.: Cape May, *MacKenzie* 6680 (NY). Hunterdon Co.: Annandale, *Fisher s.n.* (NY).

NEW YORK

Westchester Co.: Tarrytown, *Barnhart* 661 (NY).

PENNSYLVANIA

Philadelphia Co.: Philadelphia, *Parker s.n.* (F, GH).

SOUTH CAROLINA

Beaufort Co.: Beaufort, *Churchill s.n.* (GH, MIN, MO). Charleston Co.: Charleston, *Stewart s.n.* (F).

TENNESSEE

Davidson Co.: Nashville, *Gattinger s.n.* (US).

TEXAS

Bexar Co.: San Antonio, *Jermy s.n.* (NY). Cameron Co.: Brownsville, *Runyon s.n.* (TEX). Hildalgo Co.: 8 miles s. of Alamo, *Clover* 778 (CAS, DS). Real Co.: Leakey, *Cory* 44481 (TEX). Travis Co.: Austin, *Tharp* s.n. (TEX). Webb Co.: Laredo, *Reverchon s.n.* (MO).

VIRGINIA

Frederick Co.: Winchester, *Hall s.n.* (F).

WASHINGTON, D. C.

Washington, *Steele s.n.* (US).

BAHAMA ISLANDS.

Acklin's I.: Spring Point, *Brace* 4512 (F). Eleuthera I.: no locality, *Hitchcock s.n.* (MO). Fortune I.: no locality, *Hitchcock s.n.* (MO). Grand Turk I.: no locality, *Millspaugh & Millspaugh* 8988 (F, NY). Great Bahama I.: Eight Mile Rocks, *Britton & Millspaugh* 2366 (F, NY). Great Inagua I.: Matthew Town, *Nash & Taylor* 1356 (NY). New Providence I: Nassau, *Wight* 7 (F, GH, NY). North Bimini I.: no locality, *Howard & Howard* 10099 (SMU, US).

BERMUDA.

Spanish Point, *Brown & Britton* 182 (F, GH, NY, US); near Frascati, *Collins* 192 (F, GH, NY, US); The Flatts, *Moore* 2854 (CAS, GH).

WEST INDIES. CUBA

Santiago de las Vegas, *Baker & Wilson* 529 (CAS, F, MIN, POM, UC, US); Rodas, *Combs* 485 (F, GH, MO, NY); Pinar del Río, *Palmer & Riley* 387 (NY, US); Colonia Limones, Ingenio Soledad, near Cienfugos, *Pringle* 50 (GH, US); Santiago, *Underwood & Earle* 170 (NY); Herradura, *Van Hermann* 578 (F, NY).

DOMINICAN REPUBLIC

Guayubín, alt. 100 m. or less, *Abbott* 909 (US); Piedra Blanca, alt. 200-500 m., *Allard* 14477 (US); Santiago, Eggers 1995 (US); San Cristóbel, *Faris* 62 (US); Habanera, am Yaqui Fluss, Prov. Barahona, alt. 50 m., *Fuertes* 138 (F, GH, MIN, MO, NY, US); Hondo Valle, alt. 3500 ft., *Howard & Howard* 8784 (NY); Azua, *Rose, Fitch & Russell* 3899 (NY, US); Monción, alt. 375 m., *Valeur* 149 (F, MO, NY, US).

HAITI

Ennery, alt. 330 m., *Ekman* H. 9667 (US); Port au Prince, *Leonard* 2809 (NY, US); St. Marc, *Leonard* 2899 (GH, US); Fond Parisien, Etang Saumatre, *Leonard* 4170 (GH, US); Gros Morne, alt. 235 m., *Leonard* 9895 (GH, NY, US); Tortue I., *Leonard & Leonard* 15605 (US).

JAMAICA

Mandeville, *Churchill s.n.* (GH); Kingston, alt. 500 ft., *Clute* 25 (MIN, MO, US); Grand Cayman I., Georgetown, *Millspaugh* 1400 (F).

Leeward Islands

Antigua I.: no locality, *Rose, Fitch & Russell* 3416 (US). Dominica I.: West Cabrit, Portsmouth, alt. 183 m., *Hodge* 3707 (GH). Guadeloupe Is.: Basse Terre, Les Saintes, Marie Galante Islands, *Duss* 2434 (F, GH, MO, NY, US); Capesterre, alt. 25 m., *Stehlé* 630 (US). St. Kitts I.: Basseterre, *Britton* 759 (NY).

Puerto Rico

San Juan, *Heller & Heller* 313 (F, NY); 7 miles s. of Caguas, alt. ca. 2300 ft., *Heller & Heller* 313 (US); Guánica, *Millspaugh* 709 (F); Ponce, *Prey* 3 (US); Vieques I., Isabel Segunda to Mosquito, *Shafer* 2845 (NY, US); no locality, *Wydler s.n.* (NY).

Virgin Islands

St. Croix I.: Bassin field, *Ricksecker* 101 (F, GH, MIN, MO, NY, UC, US). St. Thomas I.: no locality, *Eggers s.n.* (MIN, MO); no locality, *Eggers* 204 (GH, UC). Tortola I: Exp. Sta., *Fishlock* 10 (NY, US). Virgin Gorda I.: no locality, *Fishlock* 196 (NY).

Windward Islands

Barbados I.: St. Michael, *Barrow* 8 (NY, US). Bequia I: no locality, *Joseph* B.233 (NY). Grenada I.: Grand Anse, *Broadway s.n.* (F, GH, NY). Martinique I.: Ste. Anne, *Duss* 1776 (NY).

MEXICO. Campeche

Campeche, *Goldman* 527 (US); Tuxpeña, *Lundell* 1122 (DS, F, MO, NY, US); Champotón, *Steere* 1719 (F).

Guerrero

Pungarabato, *Hinton et al.* 7283 (GH, NY, US); Acapulco, *Palmer* 553 (GH, US).

Nuevo León

Monterrey, alt. 500 m., *Abbon s.n.* (F, GH, UC); Sabinas Hidalgo, alt. 2000 ft., *Leavenworth* 53 (F); Montemorelos, *Nelson* 6698 (US).

Oaxaca

Between Llano Grande and Pinotepa, alt. 200-500 ft., *Nelson* 2337 (US); Oaxaca, *Rose & Hough* 4653 (US); near Tomellín, *Rose, Painter & Rose* 10090 (US); Cuicatlán, alt. 1800 ft., *Smith* 506 (GH).

Quintana Roo

San Miguel, Cozumel I., *Millspaugh* 1497 (F).

San Luis Potosí

19.3 miles s.w. of Nuevo Morelos (0.4 mile s.w. of Las Abritas), *Ownbey & Ownbey* 2045 (GH, MIN, US).

Tabasco

Entre la hacienda "El Cometa" y S. Juan Bautista, *Rovirosa* 98 (US).

Tamaulipas

Tampico, *Berlandier* 2 (F); Hacienda Santa Engracia, 40 miles n.w. of C. Victoria, alt. 240 m., *Meyer & Rogers* 2836, *in part* (MIN); 1.1 miles n. of El Limón (7.9 miles n. of El Mante), *Ownbey & Ownbey* 1414 (MIN); 24.2 miles s. of El Mante (38 miles n. of Valles), *Ownbey & Ownbey* 1418 (MIN); Tampico, alt. ca. 15 m., *Palmer* 111 (CAS, F, GH, K, MO, NY, US).

VERA CRUZ

Wartenberg, near Tantoyuca, *Ervendberg* 292 (NY); Veracruz, *Müller* 1855 (NY); Catemaco, alt. 1000 ft., *Nelson* 398 (US); Camarón, *Purpus* 8577 (GH, MO, NY, UC, US); Jalapa, alt. 4000 ft., *Smith* 1763 (NY).

YUCATÁN

South Kancabconot, *Gaumer* 23615 (F, GH, US); Izamal, *Gaumer* 562 (CAS, DS, F, GH, MO, NY, UC, US); Mérida, *Valdez* 16 (F, GH, MO, NY, US).

CENTRAL AMERICA. BRITISH HONDURAS

El Cayo, *Bartlett* 12965 (NY, US); America's Estate, Corozal Dist., *Gentle* 4958 (F, NY, US).

COSTA RICA

Alajuela, *Alfaro* 5705 (F, GH, US); Escasú, alt. ca. 1250 m., *Standley* 32375 (US); Cartago, *Stork* 300 (US).

EL SALVADOR

San Salvador, *Calderón* 189 (GH, NY, US); one-fourth mile s. of Santa Tecla, alt. ca. 625 m., *Carlson* 68 (CAS, F, MO, UC); Ahuachapán, alt. 800-1000 m., *Standley* 20232 (GH, US); San Vicente, alt. 350-500 m., *Standley* 21250 (US); Acajutla, alt. 30 m. or less, *Standley* 21939 (GH, US); Armenia, *Standley* 23464 (US).

GUATEMALA

La Libertad, *Aguilar* 399 (F); San Andrés, alt. 100-500 m., *Cook & Martin* 183 (US); Zacapa, alt. 620 ft., *Deam* 157 (GH); between Amatitlán and Palín, *Greenman & Greenman* 5877 (GH, MO); Santa Rosa, *Heyde & Lux* 2940 (GH, US); Casillas, *Heyde & Lux* 4307 (GH, US); Barranquilla, alt. 1800 ft., *Popenoe* 971 (US); Chilloin (?), alt. 1500 m., *Rójas* 68 (F, GH, MO, NY, US); Los Amates, alt. ca. 85 m., *Standley* 24353 (GH, US); Antigua, alt. 1500-1600 m., *Standley* 60381 (F); Jutiapa, alt. ca. 850 m., *Standley* 75821 (F); Cuilapa, alt. ca. 895 m., *Standley* 78127 (F); Chimaltenango, alt. ca. 1830 m., *Standley* 80089 (F); Sayaxché, alt. 50 m., *Steyermark* 46281 (F, UC, US).

HONDURAS

n.e. of Zamorano, alt. 850 m., *Molina* 883 (F); Comayagua, alt. ca. 600 m., *Standley & Chacón* 6040 (F).

NICARAGUA

Managua, *Baker* 700 (POM, US); between Managua and Asososca, *Greenman & Greenman* 5646 (GH, MO); Sangsangta Dist., *Schramm s.n.* (F); Sierra de Managua, region of Los Nubes, *Standley* 8709 (F); Esteli, alt. ca. 680 m., *Standley* 20224 (F).

PANAMA

Santa Rita Trail, *Cowell* 114 (NY).

2a. ARGEMONE MEXICANA L. f. **leiocarpa** (Greene) G. B. Ownb., stat. nov.

A. leiocarpa Greene, in Pittonia 3: 345. 1898; Small, Fl. s.e. U. S., p. 462. 1903; Fedde, in Pflanzenr. 4 (104): 278, 274, fig. 36E. 1909; Small, Fl. Flor. Keys, p. 52. 1913; Small, Man. s.e. Fl., p. 548. 1933.

A. mexicana var. δ Torr. & Gray, Fl. N. Am. 1: 61. 1838.

A. mexicana var. *leiocarpa* Prain, in Journ. Bot. 33: 311. 1895, provisional name with no taxonomic standing.

A. alba var. *leiocarpa* Fedde, in Pflanzenr. 4 (104): 279. 1909, nomen nudum in synonomy; not *A. alba* Lestib.

A. leiocarpa var. *mexicanoides* Fedde, l.c.
A. leiocarpa var. *ochroleucoides* Fedde, l.c.
A. mexicana var. *anacanthoidea* Fedde, l.c., nomen nudum in synonomy.
A. mexicana var. *ochroleuca* subvar. *inermis* Fedde, l.c., nomen nudum in synonomy; not *A. ochroleuca* Sweet.

Differs from the typical component of the species only in the stems, leaf surfaces, buds and capsules which are totally devoid of spines or prickles of any sort. (Ill.: Fig. 2, 4; Dist.: Fig. 5.)

Lectotype: *Charles L. Pollard, G. N. Collins and E. L. Morris* 2, collected at Key West, Florida (Plants of Subtropical Florida), March 9, 1899 (ND; isotypes, F, MIN, NY, US).

Habitat and distribution: Now occurring as a weed in disturbed or waste areas, southern Florida, Florida Keys and Dry Tortugas at elevations of near sea level. According to Prain (1895, p. 311-312) also found in West Africa and Brazil.

Flowering and fruiting dates: At any time of the year as local conditions permit; most commonly flowering from January to March and fruiting from February onward.

The distinguishing features of f. *leiocarpa* are maintained even when it is growing with plants of typical aspect. Probably these differences are controlled by only one, or at most a very few genes. Until experimental evidence bearing upon its genetic relationship to *A. mexicana* proper is available for more exact determination of its status, its treatment as a forma seems fully justified.

Torrey and Gray, l.c., first noted that *A. mexicana* sometimes has smooth capsules. The distribution of their unnamed variety is given as Key West, and thus there can be no doubt that they referred to the present f. *leiocarpa*. They cite no collections or literature references. Prain, l.c., first suggested that the smooth capsuled *A. mexicana* be called var. *leiocarpa*. Greene followed Prain's suggestion by valid publication of the name but as a new species. Fedde attempted to separate Greene's *A. leiocarpa* into two components which he called varieties: var. *mexicanoides* included the lectotype of the species; var. *ochroleucoides* was a new segregate also based upon specimens from Key West. I have seen specimens of these two "varieties" which were annotated by Fedde (US). The differences pointed out by Fedde in capsule shape and style length are minor and are probably due more to a difference in age of the capsules than otherwise. There is no justification for separating f. *leiocarpa* into two components.

In his original discussion of *A. leiocarpa*, Greene mentioned collections made by Pollard and his companions from Key West. I have chosen to designate this the type collection of the forma although it was by no means the first time the plant was collected at this locality. Greene also mentions collections of the taxon sent to him from Tampa, Florida where they

were made by Tidestrom. I have turned up none of these latter specimens in any of the major herbaria in the United States and they may no longer be in existence.

It is of some interest to review the modern distribution of f. *leiocarpa*. It seems almost certain that this variant originated on the island of Key West where it occurs intermixed with plants of typical character. Its occurrence in south Florida and other islands could be entirely due to introductions. Similarly its occurrence in Brazil and West Africa is undoubtedly due to introductions of either the forma or of the typical phase of the species. One might speculate that if the differences between the typical phase of the species and the forma, genetically speaking, are really due to a single factor difference, then a single mutation resulting in the glabrous phase might occur more than once in widely separated parts of the species distribution.

Specimens examined: UNITED STATES.

FLORIDA

Dade Co.: outskirts of Florida City, *Ownbey & Ownbey* 1361 (MIN). Lee Co.: Myers, July, *Hitchcock s.n.* (F). Hillsborough Co.: no locality, *Fredholm* 6250 (GH, MO, US). Monroe Co.: Key West, *Curtiss* 5653, *in part* (US, holotype of *A. leiocarpa* var. *ochroleucoides* Fedde; isotypes, F, GH, KSC, MIN, MO, UC, US); Garden Key, Tortugas group, *Lansing* 2531 (F); Key West, *Pollard, Collins & Morris* 2 (ND, lectotype of *A. leiocarpa* Greene; isotypes, F, MIN, NY, US; also type collection of *A. leiocarpa* var. *mexicanoides* Fedde, holotype, US); Crawl Keys, *Small & Carter* 2962 (NY); near Flamingo, *Small* 7656 (NY, US); Loggerhead Key, Dry Tortugas, *Taylor s.n.* (NY). Polk Co.: Carter's Corner, vicinity of Lakeland, *McFarlin* 4469 (CAS).

3. ARGEMONE OCHROLEUCA Sweet, Brit. Fl. Gard. 3: t. 232. 1829.

Annual or short-lived perennial with bright yellow to orange latex; stems 1-few, 3-10 (-12) dm. tall, branched in the upper portion, armed with widely spaced, perpendicular or slightly reflexed stoutish prickles; leaves very glaucous, the light blue areas over the veins very conspicuous, the largest basal leaves sometimes 35 cm. or more long, oblanceolate, the middle and upper leaves elliptical to ovate, not clasping, or the uppermost ones slightly clasping, both basal and cauline leaves mostly deeply lobed to near the midrib, the lobes oblong, the lower surfaces distantly prickly on the veins, the upper surfaces weakly and very sparingly prickly on the veins or more often totally smooth; buds oblong, the body 4-11 mm. wide, 8-18 mm. long, with about 3-6 or more fine prickles on each sepal, the slender sepal horns round in cross-section, smooth, 5-12 mm. long including the slender terminal spine; flowers 3-7 cm. in diameter, closely subtended by 1-2 bracteate leaves; petals very pale lemon-yellow, lemon-yellow or rarely darker yellow, obcuneate, obcuneate-obovate or narrowly elliptical; stamens about 20-75, the filaments pale yellow, the anthers darker yellow; stigma purple, about 2-3 mm. wide and 1.0-1.5 mm. high, the lobes spreading, the bluish, non-receptive surfaces between them usually clearly visible; style evident in fruit, about 1-3 mm. long; capsules 3-6-carpellate, lanceolate, ovate-lanceolate to occasionally oblong-elliptic, the width, excluding the spines, 10-18 mm., the length, including the stigma and style, 20-50 mm., the armature consisting of stout, rather even-sized spines, these sometimes interspersed with smaller spines, the larger spines spreading or visibly reflexed, well-spaced, about 6-12 mm. long, the capsular surface clearly visible through the armature; seeds 1.5-2.0 mm. long.

Holotype: Sweet, l.c., states that "The specimens from which our drawing was made, were kindly sent to us by Robert Barclay, Esq. in whose superb collection at Bury-Hill they were raised last Spring from seeds received from Mexico, ..." At the Royal Botanic Gardens, Kew, there is preserved a specimen of *A. ochroleuca* cultivated in Barclay's garden. It probably is not possible at this date to establish that this specimen positively was the material from which the original description and illustration of the species were drawn. I think, however, that the probability of this being the case is sufficiently great that this specimen may be designated the holotype. The illustration accompanying the original description is of such excellence that the identity of the species is unmistakable.

Key to the subspecies:

1. Buds, excluding the sepal horns, 8-11 mm. wide x 15-18 mm. long; flowers 4-7 cm. in diameter; petals obcuneate, lemon-yellow; capsule armature of rather even-sized large spines with few if any smaller ones ..... 3a. *A. ochroleuca* subsp. *ochroleuca*
1. Buds, excluding the sepal horns, 4-6 mm. wide x 8-12 mm. long; flowers 3-5 cm. in diameter; petals narrowly elliptical, pale lemon-yellow; capsule armature of larger spines intermingled with smaller spines and prickles ..... 3b. *A. ochroleuca* subsp. *stenopetala*

3a. Argemone ochroleuca Sweep subsp. ochroleuca

A. ochroleuca Sweet, Brit. Fl. Gard. 3: t. 242. 1829; Walp., Rep. 1: 110. 1842; Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879; Rose, in Contr. U. S. Nat. Herb. 8: 25. 1903.

A. barclayana Penny ex Loud., in Gard. Mag. 6: 115. 1830; Loud., Hort. Brit., first add. suppl., p. 581. 1832, excluding *A. intermedia* Sweet, in synonomy.

A. mexicana var. *ochroleuca* Lindl., in Edward's Bot. Reg. 16: t. 1343. 1830; Prain, in Journ. Bot. 33: 310. 1895, as to Mexico distribution; Fedde, in Pflanzenr. 4 (104): 277, 274, fig. 36C. 1909, excluding Yucatan specimen cited; not *A. mexicana* L.

A. sulphurea Sweet ex Loud., Hort. Brit., p. 216. 1830.

A. mexicana var. β Torr. & Gray, Fl. N. Am. 1: 61. 1838; Walp., Rep. 1: 109. 1842; not *A. mexicana* L.

A. vulgaris β Spach, Hist. Nat. Vég. 7: 26. 1839.

A. mexicana Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879, in part; Vasey & Rose, in Contr. U. S. Nat. Herb. 1: 65. 1890; Johnston, in Proc. Calif. Acad. 12: 1024. 1924; Gentry, Río Mayo Pl., in Carn. Inst. Wash. Pub. 527. 1942; Kearn. & Peeb., Fl. Pl. Ariz., p. 336. 1942; Kearn. & Peeb., Ariz. Fl., p. 324. 1951; not *A. mexicana* L.

A. platyceras Wats., in Proc. Am. Acad. 17: 318. 1882, as to *Parry & Palmer* 10; Hemsl., Biol. Cent. Am., Bot. 4:4. 1886, as to *Parry & Palmer* 10; not *A. platyceras* L. & O.

A. mexicana var. (*?*) Wats., in Proc. Am. Acad. 24: 38. 1888; not *A. mexicana* L.

A. mexicana var. *ochroleuca* "spp. *parviflora*" Prain, in Journ. Bot. 33: 310. 1895, nomen nudum; Fedde, in Pflanzenr. 4 (104): 277. 1909, nomen nudum; not *A. mexicana* L.

A. ochroleuca var. *barclayana* Prain, in Journ. Bot. 33: 325. 1895, provisional name having no taxonomic standing.

Annual or short-lived perennial; buds oblong, the body 8-11 mm. wide, 15-18 mm. long, the slender sepal horns 8-12 mm. long including the slender terminal spine; flowers 4-7 cm. in diameter; petals lemon-yellow, rarely darker yellow, the outer ones obcuneate, the inner ones obcuneate-obovate; stamens about 40-75; style in fruit 1-3 mm. long, rarely longer; capsules 4-5 (3-6) -carpellate, the width, excluding the spines, 14-18 mm.,

the length, including the stigma, 35-50 mm., the armature consisting of stout, rather even-sized spines, the larger spines 8-12 mm. long; longest dimension of seeds 1.5-1.8 mm. (Ill.: Fig. 3, 4-5; Dist.: Fig. 5.)

Holotype: That of the species.

Habitat and distribution: A common weed in disturbed soil along roadways, fields, arroyos, embankments, hills and intermountain plains throughout Mexico, except in the eastern lowlands and southern states, but most typical of the plateau region; also in the arid areas of western Mexico, Baja Canifornia del Sur and the Tres Marías Islands, its native area now indeterminable because of widespread introductions; reported from Australia. It occurs at sea level in western Mexico to altitudes of 7,500 feet on the central plateau of Mexico.

Flowering and fruiting dates: May be expected to flower and fruit during any month of the year where local conditions are suitable. Growth is most evident during the winter and early spring months in the dry areas of western Mexico; in the highlands of central Mexico the seasons of maximum flowering and fruiting are summer and fall.

A. ochroleuca subsp. *ochroleuca* is unknown to occur outside of Mexico except for introductions in Australia. I have seen one Australian specimen, *Smith* 363, from Kangaroo Pt. (GH). Doubtless there are other collections in Australian and English herbaria.

Both Prain and Fedde in their monographs of *Argemone* included much material from Argentina, Chile, Bolivia, Peru, Paraguay, Uruguay and Ecuador under *A. ochroleuca*. Most if not all of the specimens cited by these authors belong, not with *A. ochroleuca*, but with a native South American species, closely related to, but specifically distinct from *A. ochroleuca* and *A. mexicana*.

A. ochroleuca subsp. *ochroleuca* is most often confused with *A. mexicana*. Some principal differences between the two taxa were well stated by Sweet in the original description of *A. ochroleuca*. Sweet pointed out that *A. ochroleuca* had narrower, more deeply divided and sharper pointed leaves and distinctly spreading stigmas, *A. mexicana* having the stigmas closely crowded together. The stigmatic character is particularly useful. In *A. ochroleuca* the stigmatic lobes are divergent and not appressed to the style and the bluish non-receptive areas between them are visible. In *A. mexicana* the stigmatic lobes are appressed to the style and the non-receptive areas between them are ordinarily completely hidden by the receptive surfaces. *A. ochroleuca* also has pale lemon-yellow petals whereas *A. mexicana* has bright yellow petals but some intergradation in this feature is found. Another good difference resides in the buds, oblong in *A. ochroleuca*, more nearly subspherical in *A. mexicana*. In separating typical *A. mexicana* from var. *ochroleuca*, Prain referred to a difference in length of

style, "subnullo" in var. *typica*, "distincto" in var. *ochroleuca*. Most plants of *A. ochroleuca* do have a distinct style in fruit but the style in *A. mexicana* is also sometimes very evident. This distinction, therefore, seems to be of limited value.

Almost from the beginning there has been doubt among taxonomists as to whether *A. ochroleuca* should be accorded full specific rank or should be reduced to varietal status under *A. mexicana*. Soon after its original publication as a species by Sweet it was published as variety γ of a broadly drawn *A. mexicana* which also included *A. albiflora* by Lindley in the Botanical Register. Prain, (l.c., p. 325) with serious reservations followed Lindley. Fedde, (l.c., p. 277) also accorded *A. ochroleuca* only varietal rank; Rose, (l.c., p. 25) accorded *A. ochroleuca* full specific rank. In comparing it with *A. mexicana*, Rose pointed out the "somewhat thicker leaves, with stouter, more spinescent teeth" and said that in *A. ochroleuca* "The color of the flowers is pale lemon, while that of *mexicana* is always orange yellow."

In my opinion *A. mexicana* and *A. ochroleuca* are specifically distinct. Most of the confusion between the two arises from the study of pressed specimens; much immature material with inadequate data has accumulated in herbaria. In addition to the reasons already given for this treatment, there is also the distinctive distributional patterns of the two. Certainly these patterns are associated with distinctive environmental requirements. In several garden cultures that I have grown of both *A. ochroleuca* subsp. *ochroleuca* and *A. mexicana* the somatic number of chromosomes has always been 56 in the former and 28 in the latter. The two taxa are very much alike in cultural characteristics; both are easily grown in a single season from seeds; individual plants of either species are highly self-compatible.

A. Barclayana Penny (MSS., not seen) was a horticultural name taken up by Loudon, and was never adequately described. None of Penny's material is preserved at either Kew or the British Museum according to Prain (l.c., p. 325). Prain writes that a plant known as *A. Barclayana* was grown in English gardens for some years after the date of publication of the name. One of these garden specimens is preserved at Kew, and on this basis Prain associates the name *A. Barclayana* with the element of *A. ochroleuca* occurring in Baja California and coastal northwestern Mexico. There may, indeed, be a race of *A. ochroleuca* occupying the area specified by Prain as well as the Tres Marís Islands. I have not found sufficient basis for its taxonomic recognition to date. Whether this coastal element of *A. ochroleuca* is really identifiable with *A. Barclayana* Penny as averred by Prain has not been finally proved. For the present, *A. Barclayana* should remain a synonym of *A. ochroleuca* subsp. *ochroleuca*.

FIG. 3. 1-3. *A. ochroleuca* subsp. *stenopetala*. 1. Open flower × 1. Isotype, *Pringle* 43 (F). 2. Capsule × 1. Same as 1. 3. Habit × 1. Isotype, *Pringle* 43 (US). 4-5. *A. ochroleuca* subsp. *ochroleuca*. 4. Habit × 1. *Pringle* 8347 (US). 5. Capsule × 1. *Pringle* 11918 (US).

Two color forms of *A. ochroleuca* subsp. *ochroleuca* grow intermixed at Guaymas, Sonora. One form has the lemon-yellow petals of typical subsp. *ochroleuca*. The other form has bright yellow petals similar to those of *A. mexicana*. The two forms are not otherwise distinguishable. Although *A. gracilenta* sometimes occurs at the same localities, I am convinced that it is reproductively isolated under natural conditions and plays no part in the color variation in *A. ochroleuca*. The need for further study of subsp. *ochroleuca* from Guaymas is indicated.

I have observed several putative natural hybrids of *A. ochroleuca* subsp. *ochroleuca* X *A. pleiacantha* subsp. *pleiacantha* in the field. For a fuller discussion of this subject see the discussion under the latter taxon. A cytogenetic study of the two taxa and their hybrids is much needed.

Specimens examined: MEXICO.

AGUASCALIENTES

14.8 miles n. of Aguascalientes, Hwy. 45, *Ownbey & Ownbey* 1437 (MIN); 5 miles e. of Aguascalientes on road to San Luis Potosí, *Ownbey & Ownbey* 2038 (BM, GH, MEXU, MIN, NY, UC, US).

BAJA CALIFORNIA

Todos Santo, *Brandegee s.n.* (UC); La Paz, *Brandegee s.n.* (UC); San José del Cabo, *Brandegee s.n.* (UC); 26.5 km. s.e. of La Paz on road to Las Planes, *Carter* 2632 (DS, UC, US); Cape San Lucas, *Rose* 16946 (US); La Paz, *Palmer* 55 (GH, US); Cape San Lucas, *Xantus* 1 (US).

CHIHUAHUA

Presa de Chihuahua, *Le Sueur* 638 (CAS, F, MO, SMU, TEX, UC, US); 3.5 miles s.e. of Meoqui, *Ownbey & Ownbey* 1460 (ARIZ, BM, MICH, MIN, NY, UC); 31.0 miles n.e. of Hildalgo del Parral on road to Jiménez, *Ownbey & Ownbey* 1847 (MIN); 2.4 miles s.e. of Hidalgo del Parral, *Ownbey & Ownbey* 1849 (MICH, MIN); 14.4 miles s.w. of Chihuahua on road to Ciudad Guerrero, *Ownbey & Ownbey* 2011 (COLO, F, ILL, K, MIN); vicinity of Chihuahua, alt. about 1300 m., *Palmer* 152 (F, GH, MO, NY, US); valley near Chihuahua, *Pringle* 257 (F, GH, ND, NY, RSA, US); Chihuahua city, *Rose & Hough* 4207 (US); 6 miles w. of Camargo, alt. 4000 ft., *Shreve* 8069 (F); Sta. Eulalia, *Wilkinson* 4600 (NY); San Lorenzo, *Wislizenus* 282 (MO).

COAHUILA

Múzquiz, *Marsh* 21 (TEX); Monclova, *Marsh* 1675 (F, TEX); 23 miles s.w. of San Pedro, Hwy. 230, *Ownbey & Ownbey* 1450 (MIN, POM, SMU); Torreón, *Palmer* 477 (F, GH, MO, NY, UC, US).

COLIMA

Colima, *Palmer* 80 (US).

DURANGO

Durango, alt. 6300 ft., *Fisher* 44290 (MO, NY); 37.8 miles s.e. of turnoff to Villa Ocampo, Hwy. 45, *Ownbey & Ownbey* 1456 (GH, MEXU, MIN); 41.5 miles s.e. of Hidalgo del Parral, *Ownbey & Ownbey* 1856 (MIN); 17.3 miles s.w. of Ciudad Lerdo on road to Durango, *Ownbey & Ownbey* 1863 (MICH, MIN); 5.4 miles s.w. of Cuencamé on road to Durango, *Ownbey & Ownbey* 1867 (MIN); Durango, *Palmer* 241 (F, GH, MO, NY, UC, US).

FEDERAL DISTRICT

Mexico City, alt. 7300 ft., *Pringle* 8347 (F, GH, MEXU, MIN, MO, ND, NY, POM, RM, UC, US); about Mixcoac, alt. 7300 ft., *Pringle* 11918 (F, GH, US); near Guadalupe, *Rose & Hough* 4542 (US).

GUANAJUATO

Puerto de Nieto, *Kenoyer* 2036 (GH); 12.5 miles e. of Celaya, between Querétaro and León, *Ownbey & Ownbey* 2050 (CAS, F, GH, MIN, NY, UC); 5.1 miles n.w. of León on road to Lagos de Moreno, *Ownbey & Ownbey* 2051 (BM, MIN, MO, US).

GUERRERO

Placeres, *Hinton et al.* 9999 (NY, UC, US); Placeres-Cigarrillo, alt. 400 m., *Hinton et al.* 10014 (NY, TEX, US); Vallecitos, *Hinton et al.* 11789 (GH, NY, US).

HIDALGO

7.9 miles n. of Tasquillo, Hwy. 1, *Ownbey & Ownbey* 1421 (BM, F, MEXU, MICH, MIN, NY, UC, US); 14.1 miles s.e. of Ixmiquilpan, Hwy. 1, *Ownbey & Ownbey* 1422 (GH, MIN); 9.6 miles w. of junction of Hwy. 85 (to Mexico City) and Hwy. 45 (to Querétaro), *Ownbey & Ownbey* 2049 (MIN).

JALISCO

Puerta Vallarta, *Howell* 10325 (CAS); Guadalajara, *Jones s.n.* (CAS, DS, POM); between San Sebastián and Las Palmas, alt. 2000-3500 ft., *Nelson* 4133 (US); 37 miles s. of Guadalajara near w. end of Lake Chapala, *Ownbey & Ownbey* 1434a (GH, MEXU, MICH, MIN); n. of Lagos de Moreno, *Ownbey & Ownbey* 1436 (MIN); 11.6 miles n.e. of Tepatitlán, Hwy. 34, *Ownbey & Ownbey* 1435 (F, MIN); Guadalajara, *Woodruff s.n.* (NY).

MÉXICO

Near México, *Bourgeau* 6 (GH, US); Ypericones, alt. 1500 m., *Hinton* 3827 (GH, NY, US); Nanchititla, *Hinton et al.* 7355 (CAS, GH, K, NY, US); Naranjo, *Hinton et al.* 7520 (GH, K, NY); Amecameca, alt. 8600 ft., *Kuntze* 23651, *in part* (NY).

MICHOACÁN

Morelia, *Arsène* 3310 (NY, US); 2 km. w. of Zamora, alt. 1567 m., *Cutler* 4047 (F); Coalcomán, alt. 1000 m., *Hinton et al.* 12963 (GH, NY, US); 2.2 miles n.w. of Tuxpan, *Ownbey & Ownbey* 1430 (MEXU, MICH, MIN, US); 12.7 miles n.w. of Quiroga, *Ownbey & Ownbey* 1431 (MIN, UC); 1.0 mile e. of Carapán, *Ownbey & Ownbey* 1433 (MIN, NY); s.e. shore of Lake Pátzcuaro, alt. ca. 2200 m., *Schery* 149 (MO).

NAYARIT

Tepic, *Jones* 22844 (CAS, F, GH, NY, POM, UC); Acaponeta, *Jones* 23560 (CAS, GH, POM, UC); San Blas, *Maltby* 12 (US); Tres Marías Islands, *Mason* 1713 (CAS, K); same locality, *Mason* 1716 (CAS, F, NY); María Magdalena I., *Nelson* 4318 (US); vicinity of Acaponeta, *Rose, Standley & Russell* 14339 (NY, US).

PUEBLA

Rancho Posadas, vicinity of Puebla, alt. 2194 m., *Arsène & Nicolas* 62 (GH, MO, US); near Puebla, alt. 2150 m., *Grant* 560 (F, GH); San Baltazar, *Nicolas* 50 (F); Chalchicomula, *Smith s.n.* (MO).

QUERÉTARO

Querétaro, *Arsène* 10055 (US).

SAN LUIS POTOSÍ

2.7 miles n.e. of Villa de Hidalgo, *Ownbey & Ownbey* 2042 (GH, MIN, UC, US); region of San Luis Potosí, *Parry & Palmer* 10 (GH, MO, US).

SINALOA

Imala, *Gentry* 5933 (DS, MO, NY); Culicán, *Goldman*, 368 (GH, NY, US); Villa Unión, *Lamb* 406 (DS, GH, MO, ND, NY, US); San Ignacio, alt. 260 m., *Ortega* 133 (CAS, US); Mazatlán, *Ortega* 6643 (CAS, MIN, US); vicinity of Fuente, *Rose, Standley & Russell* 13476 (NY, US); vicinity of Villa Unión, *Rose, Standley & Russell* 13889 (NY, US); vicinity of Mazatlán, *Rose, Standley & Russell* 14015, 14016 (NY, US); vicinity of Guadalupe, *Rose, Standley & Russell* 14758, 14769 (NY, US).

SONORA

San Bernardo, Río Mayo, *Gentry* 1337 (F, GH, MEXU, MO, UC); 13.2 miles e. of Moctezuma on road to Huasabas, *Ownbey & Ownbey* 1775 (ARIZ, CAS, GH, MEXU, MIN, NY, RSA, UC, US); 27.9 miles s.w. of Moctezuma, *Ownbey & Ownbey* 1777a (GH, MIN, US); 1.5 miles s. of El Oasis, Magdalena-Hermosillo road, *Ownbey & Ownbey* 2085 (MIN); 4.0 miles n. of Imuris, Magdalena-Nogales road, *Ownbey & Ownbey* 2093 (MIN); Guaymas, *Palmer* 105 (GH, ND, NY, US); vicinity of Hermosillo, *Rose, Standley & Russell* 12399 (NY, US); vicinity of Alamos, *Rose, Standley & Russell* 12913 (GH, NY, US); vicinity of Navojoa, *Rose, Standley & Russell* 13125 (NY, US); vicinity of Guaymas, *Rose, Standley & Russell* 15012 (NY, US); same locality, *Rose, Standley & Russell* 15013 (NY, US); Río Yaqui, Torín, alt. 100 ft., *Studhalter* 1458 (US); Río Moctezuma, Moctezuma, *White* 325 (GH).

TAMAULIPAS

Vicinity of Victoria, alt. about 320 m., *Palmer* 79 (F, GH, K, MO, NY, US); vicinity of Tampico, alt. about 15 m., *Palmer* 315 (CAS, F, GH, K, MO, NY, US).

TLAXCALA

Mt. Malinche, San Francisco (Tetlanochan), alt. 7500 ft., *Balls*, B4899 (UC).

VERA CRUZ

Orizaba, *Nelson* 188 (US); Orizaba, *Smith* 127 (MO).

ZACATECAS

Ojo Caliente, *Jones* 86 (MO, POM, US); 17.1 miles n.w. of Sombrerete, Hwy. 45, *Ownbey & Ownbey* 1443 (MIN, US); 38.7 miles e. of Sombrerete on road to Fresnillo, *Ownbey & Ownbey* 2035 (MIN).

3b. ARGEMONE OCHROLEUCA Sweet subsp. **stenopetala** (Prain) G. B. Ownb., comb. & stat. nov.

A. intermedia var. *stenopetala* Prain, in Journ. Bot. 33: 364. 1895; Fedde, in Pflanzenr. 4 (104): 282. 1909; not *A. intermedia* Sweet.

A. stenopetala Rose, in Contr. U. S. Nat. Herb. 8: 27. 1903.

Annual; leaves deeply lobed, the sinuses broad; buds oblong, small, the body 4-6 mm. wide, 8-12 mm. long, the sepal horns 5-8 mm. long including the slender terminal spine; flowers 3-5 cm. in diameter; petals pale lemon-yellow, narrowly elliptical, about 3 times as long as broad; stamens about 20-30; style in fruit about 1 mm. long; capsules 3-5-carpellate, the width, excluding the spines, 10-18 mm., the length, including the stigma, 20-40 mm., the armature consisting of larger spines intermixed with smaller spines and prickles, the larger spines 6-9 mm. long; longest dimension of seeds 1.8-2.0 mm. (Ill.: Fig. 3, 1-3; Dist.: Fig. 5.)

Holotype: *C. G. Pringle* 43, from "Valley near Chihuahua," state of Chihuahua, Mexico, May 2 and 24, 1885 (Cosson herbarium, Paris, according to Prain, l.c., pp. 364, 365, not seen; isotypes, F, GH, ND, NY, RSA, US).

Habitat and distribution: Valleys and high plains, often in disturbed soil, at altitudes of 4500-6500 feet in its native area, northern Durango and southern Chihuahua. The records from the states of México and Michoacán doubtless are introductions.

Flowering and fruiting dates: Evidently flowers in March and continues to flower through the summer and fall as local conditions permit; fruits are matured from about April 15 to Sept. 30, or later.

Prain, l.c., while denying *A. intermedia* var. *stenopetala* full specific rank, did so with great hesitancy, mainly through reluctance to further increase the number of proposed species of *Argemone* in the absence of a more extensive suite of specimens. Rose, l.c., who had seen Prain's variety in the field raised it to specific rank without stating any reasons. He reported this taxon as occurring with *A. ochroleuca* "from which it is difficult to distinguish it except by color of the flowers." I, too, have seen the two subspecies of *A. ochroleuca* growing together as roadside weeds in northern Durango, both doubtless locally introduced. It is mainly on the basis of field observations that I herewith propose the transfer of Prain's *A. intermedia* var. *stenopetala* to *A. ochroleuca* in the higher rank of subspecies. The two subspecies of *A. ochroleuca* are indistinguishable in the field on vegetative characteristics. It is only by observing the distinctive features of the buds, petals and capsules set forth above that their individuality is apparent. No intermediates were observed in the field and it is most doubtful if they occur at all. I would, however, postulate the origin of subsp. *stenopetala* directly from subsp. *ochroleuca* despite the presence in the latter of new features not present in the former and the evident incompatibility barrier between them in nature.

Specimens examined: MEXICO.

CHIHUAHUA

23 miles s.e. of Hidalgo del Parral on road to Durango, *Ownbey & Ownbey* 1850 (BM, CAS, COLO, F, GH, MEXU, MICH, MIN, NY, RM, RSA, UC, US); valley near Chihuahua, *Pringle* 43 (isotypes of *A. intermedia* var. *stenopetala* Prain, F, GH, ND, NY, RSA, US); vicinity of Chihuahua, alt. about 1300 m., *Palmer* 153 (F, GH, K, MO, NY, US); Chihuahua city, *Rose & Hough* 4206 (US).

DURANGO

41.5 miles s.e. of Hidalgo del Parral on road to Durango, *Ownbey & Ownbey* 1857 (ARIZ, BM, GH, K, MEXU, MICH, MIN, MO, NY, POM, SMU, TEX, UC, WIS, WS); Tepehuanes, *Palmer* 36 (F, GH, K, MO, NY, US).

MÉXICO

Lechería, alt. 7400 ft., *Pringle* 11919 (F, GH, US).

MICHOACÁN

Morelia, *Arsène s.n., in part,* (US).

4. ARGEMONE **superba** G. B. Ownb., sp. nov.

Herba annua latice luteo. Caules plerumque solitarii, 3-10 dm. alti, sparse aculeati. Folia pinnatifida, superioribus minus pinnatifidis, subter in venis aculeata, supra subinermia. Alabastra subsphaerica, 12-16 mm. lata, 12-16 mm. longa, 4-12 aculeis in utroque sepalo. Sepalorum coruna inermia, teretia, 7-10 mm. longa. Flores 7-9 cm. diametro, petalis luteis, staminibus circa 150, filamentis pallide flavis, stigmatis lobis aliquantum sinuatis post anthesim. Capsulae 3-5-carpellatae, late ellipticae, crasse spinescentes. Semina non visa.

Annual with bright yellow latex; stems mostly one from the base, 3-10 dm. tall, widely branched, distantly prickly; leaves very glaucous, the blue lines over the veins pronounced, the lower ones lobed to four-fifths the distance to the midrib, the upper ones less deeply lobed, the lobes broadly oblong with acute spine-tipped marginal teeth, the sinuses narrower than the lobes, the lower surfaces of the leaves stoutly and distantly prickly on the main veins, the upper surfaces very sparingly and weakly prickly on the main veins or smooth; buds subspherical, the body 12-16 mm. broad, 12-16 mm. long, with about 4-12 prickles on each sepal, the sepal horns smooth, terete, spreading, 7-10 mm. long including the terminal spine; flowers 7-9 cm. across, closely subtended by 1-2 foliar bracts; petals bright yellow, the outer suborbicular, the inner broadly obovate-obcuneate, the outer margins minutely erose; stamens numerous, about 150, the filaments pale yellow, the anthers yellow, equalling or slightly exceeding the stigma at anthesis; stigma purple, about 2.5-3.0 mm. wide and 2-3 mm. high, the lobes usually somewhat sinuate, especially after anthesis, more or less appressed to the style at anthesis; style very short, to about 0.5 mm. long in fruit; capsules 4-5-carpellate, broadly elliptical, the mature size unknown, but within the usual range for *Argemone*, armed with stout well-spaced, even-sized spines plus a few lesser spines or prickles, the capsular surface clearly visible; seeds not seen. (Ill.: Fig. 4, 1; Dist.: Fig. 5.)

Holotype: *G. B. Ownbey & F. Ownbey* 2044, collected 13.3 miles northwest of Ciudad del Maíz, San Luis Potosí, Mexico, in deep alluvial soil of road ditch, chaparral province, Oct. 25, 1953 (MIN; isotypes, BM, CAS, F, GH, MEXU, MICH, MIN, MO, NY, UC, US).

Habitat and distribution: Chaparral province, at altitudes of about 4500-6000 feet, southern San Luis Potosí west of the Sierra Madre Oriental.

Flowering and fruiting dates: During summer and fall months.

A. superba is closely allied to *A. aenea* and should possibly be considered a subspecies thereof. They differ in the generally more nearly spherical, less prickly, smaller buds of *A. superba* and the consistently pure yellow petals and lemon yellow filaments of *A. superba* as opposed to the usually golden yellow or bronze petals and uniformly red filaments of *A. aenea*. The stigma of *A. superba* evidences a lesser tendency toward sinuate lobes than *A. aenea* and is generally smaller. Finally, the capsules of *A. superba* are generally less closely armed than those of *A. aenea*. Distributionally the two taxa are entirely allopatric, the distribution of *A. superba* being southward and westward of *A. aenea* and separated by the

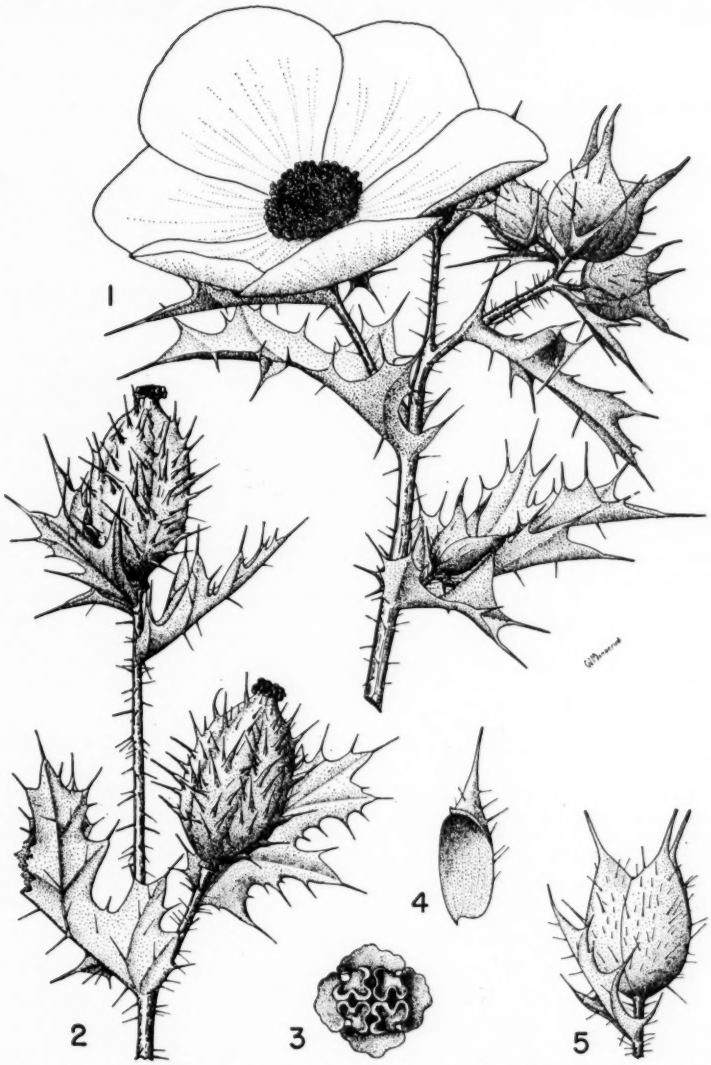

FIG. 4. 1. *A. superba.* Habit × 1. Isotype, *Ownbey & Ownbey* 2044 (MIN). 2-5. *A. aenea.* 2. Capsules × 1. *Ownbey & Ownbey* 1623 (MIN). 3. Stigma × 3. Cult. from seed of *Ownbey & Ownbey* 1409 (MIN). 4. Sepal × 1. Same as 3. 5. Bud × 1. Isotype, *Pringle* 8321 (UC).

Sierra Madre Oriental. Because of its yellow petals, *A. superba* might also be confused with *A. mexicana* or *A. ochroleuca*. It is readily separated from both of these species by its larger flowers and more numerous stamens.

Specimens examined: MEXICO.

SAN LUIS POTOSÍ

13.3 miles n.w. of Ciudad del Maíz, *Ownbey & Ownbey* 2044 (MIN, holotype of *A. superba* Ownb.; isotypes, BM, CAS, F, GH, MEXU, MICH, MIN, MO, NY, UC, US); Río Verde, *Palmer* 57, *in part* (GH, NY, US).

5. ARGEMONE **aenea** G. B. Ownb., sp. nov.

A. mexicana Fedde, in Pflanzenr. 4 (104): 275. 1909, as to *Pringle* 8321; not *A. mexicana* L.

A. platyceras Fedde, l.c., p. 283, in small part; not *A. platyceras* L. & O.

Herba annua, biennis, aut diurnitate brevi perennis, latice flavo. Caules 3-8 (-10) dm. alti, sparse aculeati. Folia profunde pinnatifida glauca. Alabastra elliptico-oblonga, 12-16 mm. lata, 15-20 (-24) mm. longa, moderate aculeata. Sepalorum cornua teretia, 7-12 (-14) mm. longa. Flores 8-10 (7-12) cm. lati, petalis flavis vel aureis vel aeneis, staminibus circa 150, filamentis rubris aut purpureis, stigmatis lobis inter anthesim sinuatis. Capsulae 4-5-carpellatae, anguste ellipticae vel elliptico-oblongae, spinis robustis magnitudine inaequalibus. Semina circa 1.5-1.7 mm. longa.

Annual, biennial or short-lived perennial with bright yellow latex; stems 1-few, 3-8 (-10) dm. tall, moderately branched, sparingly to quite evidently prickly with usually slender, perpendicular or visibly reflexed prickles; leaves glaucous, the veins prominently blue lined, the lower ones pinnatifid, the middle and upper ones sometimes less deeply cut, the lobes oblong, with acute, prickle-tipped marginal teeth, the sinuses rectangular, broad, the leaf surfaces somewhat prickly on the veins below, smooth or very sparingly prickly on the veins above; buds at flowering time elliptic-oblong, the body 12-16 mm. broad, 15-20 (-24) mm. long, moderately prickly, the sepal horns approximately round in cross section, 7-12 (-14) mm. long, smooth or with a few prickles on the herbaceous base, spine-tipped; flowers usually 8-10 (7-12) cm. broad, usually closely subtended by 1-2 foliar bracts; petals yellow to golden or bronze, sub-orbicular to very broadly obovate-obcuneate, the outer margins erose; stamens about 150, the filaments red or purplish, the anthers purplish-yellow, the stamens and ovary sub-equal at flowering time; stigma purple, 3-6 mm. wide, about 2-3 mm. high, the lobes characteristically sinuate; capsules 4-5-carpellate, narrowly elliptical to elliptic-oblong, the width, exclusive of spines, 12-16 mm., the length, including the stigma, 25-35 mm., coarsely spiny, the larger spines interspersed with smaller ones, the longest spines usually to about 8 mm. long, the capsular surface clearly visible through the armature; seeds 1.5-1.7 mm. long. (Ill.: Fig. 4, 2-5; Dist.: Fig. 5.)

Holotype: *C. G. Pringle* 8321, collected in the Río Grande Valley near Díaz, alt. 700 ft., Coahuila, Mexico, April 20, 1900 (US; isotypes, F, GH, MEXU, MIN, MO, ND, NY, POM, RM, UC, US).

Habitat and distribution: Apparently native to the dry plains, low hills and drainages of southern and western Texas and northeastern Mexico; now also a weed along roadsides, in fields, pastures and waste lots of the same area. It evidently tolerates a wide range of soil types. It is found at elevations of near sea level in the east to about 4500 ft. in the west.

Flowering and fruiting dates: First flowers appear in mid-February; flowers may continue to appear in individual plants during the spring,

summer and autumn. First fruits mature beginning about March 15 and continue to mature until autumn as local conditions permit.

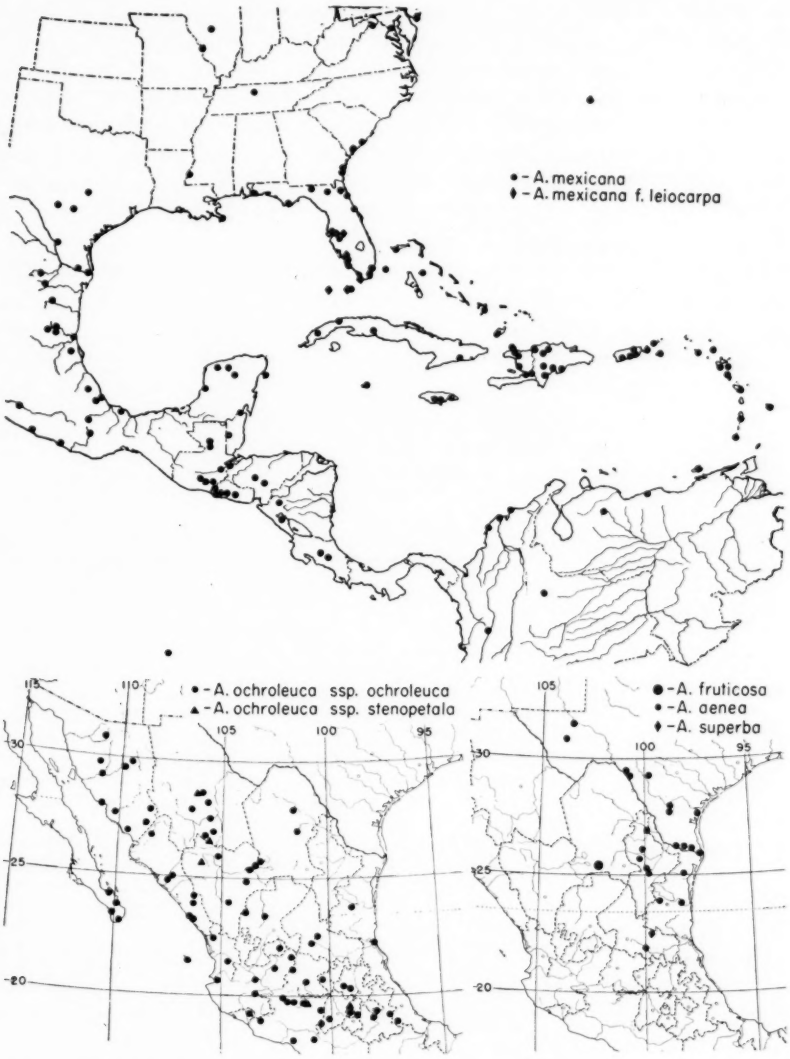

FIG. 5. Geographical distributions of species and subspecies as indicated.

A. aenea is closely related to *A. superba.* The differences between the two are set forth under the latter species. In herbaria it has usually passed as either *A. mexicana* or *A. ochroleuca* because of its flower color. It may be readily distinguished from these two species on the basis of its larger flowers, larger, more prickly buds, more numerous stamens, red or purplish filaments and usually sinuate stigmatic lobes. Superficially, if one does not take flower color into account, the resemblance of *A. aenea* to *A. sanguinea* is much closer. The only consistent morphological difference seems to lie in the stigmatic lobes which are sinuate in the former species and not sinuate in the latter species. Although these two species occur together in southern Texas, I have detected no conclusive evidence of natural hybridization between them, at least between *A. aenea* and the tetraploid form of *A. sanguinea.* One specimen, *Ownbey & Ownbey* 1627c (MIN) appears to be of hybrid origin. It was collected 1.4 miles s.e. of Garciasville, Starr Co., Texas. Two putative hybrids with salmon-pink flowers were seen at this locality growing with the presumed parents. All plants appeared fertile but seeds of one of the hybrids did not germinate when planted. It seems probable, at this writing, that hybridization between *A. aenea* and *A. sanguinea* is rare, if it occurs at all.

Specimens examined: UNITED STATES.

TEXAS

Cameron Co.: La Feria, alt. 50 ft., *Runyon* 609 (US); Brownsville, *York s.n.* (TEX). Duval Co.: 0.5 mile n. of Freer, *Cory* 55313 (SMU, US). Hidalgo Co.: 2.8 miles e. of Edinburg, *Ownbey & Ownbey* 1616 (CAS, F, GH, K, MIN, NY, RM, SMU, TEX, UC, US); 9.4 miles e. of Hidalgo, *Ownbey & Ownbey* 1623 (GH, MIN, SMU, TEX, US); Weslaco, alt. 20 m., *Runyon* 1616 (US). Jeff Davis Co.: Phantom Lake, *Cory* 18316 (GH); lower Little Aguja Canyon, Espy ranch, alt. 4800 ft., *Warnock* 8040 (SMU, very aberrant); Madera Canyon below Madera Springs, *Whitehouse* 11814 (SMU). Maverick Co.: Del Rio to Eagle Pass, *Hanson* 537 (MO, NY, US); 7.7 miles n.w. of Quemado, *Ownbey & Ownbey* 1632 (GH, MIN, NY, RSA, SMU, TEX, UC, US). McMullen Co.: 17¼ miles s. of Tilden, *Cory* 55326 (SMU). Nueces Co.: Corpus Christi, *Nealley s.n.* (F). Reeves Co.: Toyah Creek at Balmorhea, *Cory* 52241 (SMU); plains w. of Pecos, *Earle & Tracy* 423 (NY); n. edge of Davis Mts., 1 mile e. of intersection of Hwys. 80 & 290, *Waterfall* 4394 (CAS, GH, MO, NY). Starr Co.: 1.4 miles s.e. of Garciasville, *Ownbey & Ownbey* 1627b (MIN). Uvalde Co.: 10.5 miles w. of Uvalde, *Ownbey & Ownbey* 1643 (C, CAS, F, GH, K, KSC, MIN, NY, SMU, TEX, UC, US). Val Verde Co.: 11 miles s.e. of Del Rio, *Ownbey & Ownbey* 1633 (MIN, SMU); Del Rio, *Palmer* 13586 (MO, US).

MEXICO.

COAHUILA

Río Grande Valley near Díaz, alt. 700 ft., *Pringle* 8321 (US, holotype of *A. aenea* Ownb.; isotypes, F, GH, MEXU, MIN, MO, ND, NY, POM, RM, UC, US).

NUEVO LEÓN.

Monterrey, alt. 1750 ft., *Fisher s.n.*, 138 (MO, US); 38 miles s. of Nuevo Laredo on road to Monterrey, *Frye & Frye* 2359 (DS, GH, MO, NY, RSA, UC, US); Montemorelos, *Nelson* 6099, 6699 (GH, US); 6.2 miles n. of Ciénega de Flores, *Ownbey & Ownbey* 1403

(GH, K, MEXU, MIN); 17.5 miles n.w. of Montemorelos, *Ownbey & Ownbey* 1409 (GH, MEXU, MIN); San Juan, near Monterrey, *Prinkle* 11358 (US); Mt. Mitras, alt. 1645 ft., *Roybal* 17 (TEX); Cerro de la Silla, near Monterrey, alt. 1700 ft., *White* 1506 (GH).

TAMAULIPAS

54 miles s. of Matamoros, *Meyer & Rogers* 2479 (MIN, MO); Soto la Marina, *Nelson* 6053, 6653 (F, NY, US); 16.3 miles n.w. of C. Victoria, *Ownbey & Ownbey* 1412 (MIN); near Matamoros, *Tharp* 1789 (TEX, US).

6. ARGEMONE **aurantiaca** G. B. Ownb., sp. nov.

A. planchonii Prain, in Journ. Bot. 33: 369. 1895, as to Texas, provisional name having no taxonomic standing.

A. platyceras var. *typica* Prain, l.c., p. 367, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" δ Prain, l.c., p. 369, excluding *Fendler* 16; not *A. platyceras* L. & O.

A. platyceras Small, Fl. s.e. U. S., p. 462. 1903, as to Texas distribution, in part; not *A. platyceras* L. & O.

Herba annua aut biennis latice rufo-aurantiaco. Caules usque ad 8 dm. alti, late ramosi, omnino moderate vel dense aculeati, aculeis longis tenuibus perpendicularibus. Folia oblanceolata, inferioribus profunde lobatis lobis oblongis, superioribus repande lobatis ovatis amplexicaulibusque, in venis principalibus aculeata praecipue subter, aliquando utrinque inter venas sparse aculeata. Alabastra oblonga, 14-18 mm. lata, 18-25 mm. longa, aculeata. Sepalorum cornua angulata aut in sectione transverse planata, 8-12 mm. longa, aculeata. Flores foliis 1-2 reductis subtensae, 8-12 cm. diametro, petalis albis, staminibus 150 vel plus. Capsulae 5-6-carpellatae, ovatae, 15-25 mm. latae, 40-50 mm. longae stigmate includenti, spinis longis saepe ramosis herbaceis ad 35 mm. longis et aculeis multis et secundariis dense obsidentes, superficie capsulari aculeis parvis simplicibus inter spinas munita, partim obscurata. Semina 2.5-3.0 mm. longa.

Annual or biennial with reddish-orange latex; stems usually 1 from the base, to about 8 dm. tall, stout, widely branched upward, the primary branches few in number and surpassing the main axis, the plant at maturity more or less flat-topped, the stems moderately to copiously prickly throughout with long, slender, perpendicular prickles; leaves bluish, the basal and lower cauline oblanceolate, deeply lobed to four-fifths the distance to the midrib, the lobes oblong, the leaves progressively elliptical to ovate upward, less deeply lobed, the uppermost ones only shallowly lobed and often clasping the stem, all the leaves with secondary, angular lobes and points marginally, the points terminated by a usually weak spine or prickle, the leaves sparingly to copiously prickly on the veins, especially below, with slender prickles and also sometimes very sparingly prickly on the surfaces between the larger veins, especially below; buds oblong, often very large, the body 14-18 mm. broad, 18-25 mm. long, sparingly to densely prickly, the larger prickles sometimes compound, the sepal horns angular, often dorsi-ventrally flattened, usually 8-12 mm. long, prickly to the indurated apical spine; flowers closely subtended by 1-2 reduced leaves, 8-12 cm. in diameter; petals white; stamens numerous, 150 or more, the filaments pale yellow, the anthers yellow; stigma purple, 3.5-5.0 mm. wide, 2.5-3.5 mm. high, 5-6 lobed; capsules 5-6-carpellate, ovate, the body, exclusive of armature, 15-25 mm. broad, 40-50 mm. long, including the stigma, densely covered with long, herbaceous, erect or reflexed spines, these to 35 mm. long, often branched, provided with numerous secondary prickles for three-fourths their length and terminated by a slender, indurated point, the capsule also provided with small, simple prickles arising between the large spines, the capsular surface partially but not completely obscured; seeds 2.5-3.0 mm. long. (Ill.: Fig. 6, 1-5; Dist.: Fig. 13.)

Holotype: *Gerald B. Ownbey & Findley Ownbey* 1397, from 6.3 miles

northeast of San Marcos, U. S. Highway 81, Hays Co., Texas, July 12, 1950 (MIN; isotypes, GH, K, MIN, MO, SMU, US).

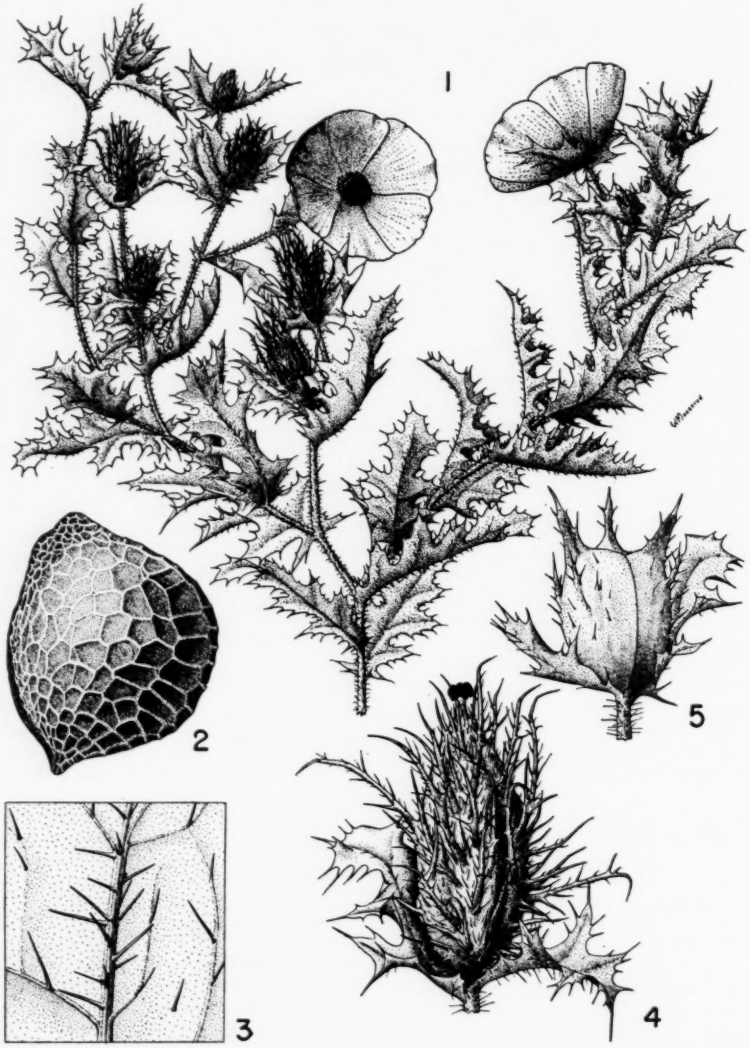

FIG. 6. *A. aurantiaca.* 1. Habit × 3/8. Holotype, *Ownbey & Ownbey* 1397 (MIN). 2. Seed × 15. *Ownbey & Ownbey* 1394a (MIN). 3. Leaf, under surface along midvein, × 4. Cult. from seeds of *Ownbey & Ownbey* 1394a (MIN). 4. Capsule × 1. Isotype, *Ownbey & Ownbey* 1397 (MIN). 5. Bud × 1. *Smith* 1154 (TEX).

Habitat and distribution: Fields and pastures, hilly terrain, often rocky, sandy soil, south-central Texas in the region of the Balcones Escarpment of the Edwards Plateau and northward along the transition zone between the lowland plains and the plateau regions to the west; introduced locally westward.

Flowering and fruiting dates: Flowering begins about April 1-15 and continues as conditions permit through the summer to August; fruits begin to ripen about May 15-30 and continue to ripen until autumn.

This species regularly has been considered a component either of *A. platyceras* L. & O. or of *A. hispida* Gray when the latter was given specific rank. Dr. David Prain first noted its distinctive capsule armature (to some degree shared only by *A. squarrosa*) and treated it as "state" ♂ of *A. platyceras* var. *typica* in his monograph of the genus. He provisionally suggested calling the species *A. Planchonii*, but the name was not accepted by him and has not since been validly published. The name may, therefore, be rejected under Article 33 of the International Code of Botanical Nomenclature, 1956 edition. I prefer to call attention to the unique latex color of this species and for this reason am naming it *A. aurantiaca*. Prain erred in placing fruiting specimens of *Fendler* 16, from the prairies, upper spring of the Cimarron, with his Texas material of this "state." This portion of *Fendler* 16 belong with *A. squarrosa* Greene subsp. *squarrosa*.

A. aurantiaca differs from *A. hispida* in the absence of hispidity on the stem and leaf surfaces and in the coarse, often branched spines of the capsules. It differs similarly from *A. platyceras* in capsule characters. The plants are coarser throughout than either *A. hispida* or *A. platyceras*. *A. aurantiaca* resembles *A. squarrosa* Greene subsp. *squarrosa* in many respects, but may be readily distinguished on the basis of the uniform hispidity of stems and leaves and shorter capsular spines of the latter. Cytologically, *A. aurantiaca* with its diploid chromosome number of 84 differs from *A. platyceras*, which has a diploid number of 28, and *A. squarrosa* subsp. *squarrosa*, which has a diploid number of about 112. The chromosome number of *A. hispida* has not yet been determined.

Specimens examined: UNITED STATES.

TEXAS

Bell Co.: Temple, *Killough* 17 (US). Bexar Co.: San Antonio, *Mr. & Mrs. J. Clemens* 795 (MO, RM); no locality, *Jermy s.n.* (MO, NY). Comal Co.: around Bracken, *Groth* 45 (CAS, F, GH, NY, US). Gillespie Co.: Harper, *Whitehouse* 702 (NY). Hays Co.: 6.3 miles n.e. of San Marcos, *Ownbey & Ownbey* 1397 (MIN, holotype of *A. aurantiaca* Ownb.; isotypes, GH, K, MIN, MO, SMU, US). Kerr Co.: no locality, *Whitehouse s.n.* (TEX). McLennan Co.: 2.4 miles s.-s.e. of Crawford, *Shinners* 14978 (SMU). Medina Co.: D'Harris, *Ownbey & Ownbey* 1400 (MIN). Taylor Co.: near Abilene along R.R., *Tolstead* 7466 (SMU, TEX, UC). Travis Co.: rim of rocks, edge of caliche pit, Zilker Park, *Barkley & Warnock* 46265 (RSA, TEX, US); 5.3 miles s.e. of Austin, *Ownbey & Ownbey* 1394a (MIN, TEX, UC). Uvalde Co.: 2.9 miles w. of

Sabinal, *Ownbey & Ownbey* 1646 (MIN). County uncertain: no locality, *Drummond* 9 (GH); between Texas and New Mexico, ex *Torrey s.n.* (GH).

7. Argemone **echinata** G. B. Ownb., sp. nov.

A. platyceras Wats., in Proc. Am. Acad. 17: 318. 1882, as to *Palmer* 19; Hemsl., Biol. Cent. Am., Bot. 4: 4. 1886, as to *Palmer* 19; Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" β Prain, l.c., p. 368, in part; not *A. platyceras* L. & O.

A. hispida Rose, in Contr. U. S. Nat. Herb. 8: 26. 1903, as to cited specimens; not *A. hispida* Gray.

A. platyceras var. *hispida* Fedde, in Pflanzenr. 4 (104): 285. 1909, in very small part; not *A. platyceras* L. & O.; not *A. hispida* Gray.

Herba perennis. Caules solitarii vel plures, 3.5-5.5 dm. alti, omnino conspicue et aliquantulum dense aculeati, aculeis tenuibus rigidis perpendicularibus magnitudine inaequalibus. Folia profunde pinnatifida lobis oblongis, lobis secundariis laneeolatis, lamina sparse aculeata vel aliquando densius aculeato-hispida utrinque inter venas principales. Alabastra elliptico-oblonga moderate aculeata. Sepalorum cornua teretia, circa 10 mm. longa, in parte basali herbacea aculeata. Flores 1-2 bracteis foliaribus subtensi, 6-10 cm. diametro, staminibus circa 100. Capsulae 3-4-carpellatae, late oblongae vel ellipticae, 10-14 mm. latae, 20-35 mm. longae, superficie spinis multis et erectis aut patentibus armatae, spinis maximis 9-11 mm. longis et ipsis aliquando aculeatis, superficie capsulari quoque spinis parvis et aculeis armatae. Semina circa 2 mm. longa.

Perennial, the latex color unknown; stems 1-several from the base, usually 3.5-5.5 dm. tall, widely branched, the branches equalling or surpassing the primary axis, the plant at maturity more or less flat-topped, the stems conspicuously and rather closely prickly throughout with very uneven-sized, slender, rigid, perpendicular prickles; leaves bluish, the upper ones not conspicuously clasping, the blades usually deeply pinnatifid to three-fourths or more of the distance to the midrib, the sinuses broad, the lobes oblong and with lanceolate secondary lobes, each of which is terminated by a stout spine, the leaves prickly on the veins below and above, and from sparsely prickly to sometimes rather closely aculeate-hispid on the surfaces between the larger veins both below and above; buds medium-sized, elliptic-oblong, the body 8-10 mm. broad, 14-18 mm. long, moderately prickly, the sepal horns terete, about 10 mm. long, prickly on the herbaceous basal portion, rarely also on the stout, indurated, terminal spine; flowers closely subtended by 1-2 foliar bracts, 6-10 cm. in diameter; petals white; stamens about 100, the filaments pale yellow, the anthers deep yellow; stigma purple, 2.5-3.5 mm. wide, 1.5-2.5 mm. high, 3-4-lobed; capsules 3-4-carpellate, broadly oblong to elliptical, the body, excluding armature, 10-14 mm. broad, the length, including the stigma, 20-35 mm., armed with numerous erect or spreading spines, the larger spines usually 9-11 mm. long and indurated to near the base, these occasionally with secondary prickles on the herbaceous basal portion, the capsule also armed with small spines and prickles, the surface obscured, but still visible; seeds about 2 mm. long. (Ill.: Fig. 7, 1-5; Dist.: Fig. 13.)

Holotype: *Dr. Edward Palmer* 208, from the vicinity of Satillo, Coahuila, Mexico, June, 1898 (US; isotypes, F. GH, MO, NY, UC).

Habitat and distribution: Flat valley floors and playas, often in deep, clay soil, eastern Coahuila, northern San Luis Potosí and western Nuevo León, Mexico, at elevations of 4500 to 6500 feet to the south, much lower to the north.

Flowering and fruiting dates: Flowers appear about May 1 and, condi-

tions permitting, continue into August; first fruits mature in early June and fruits continue to mature to September.

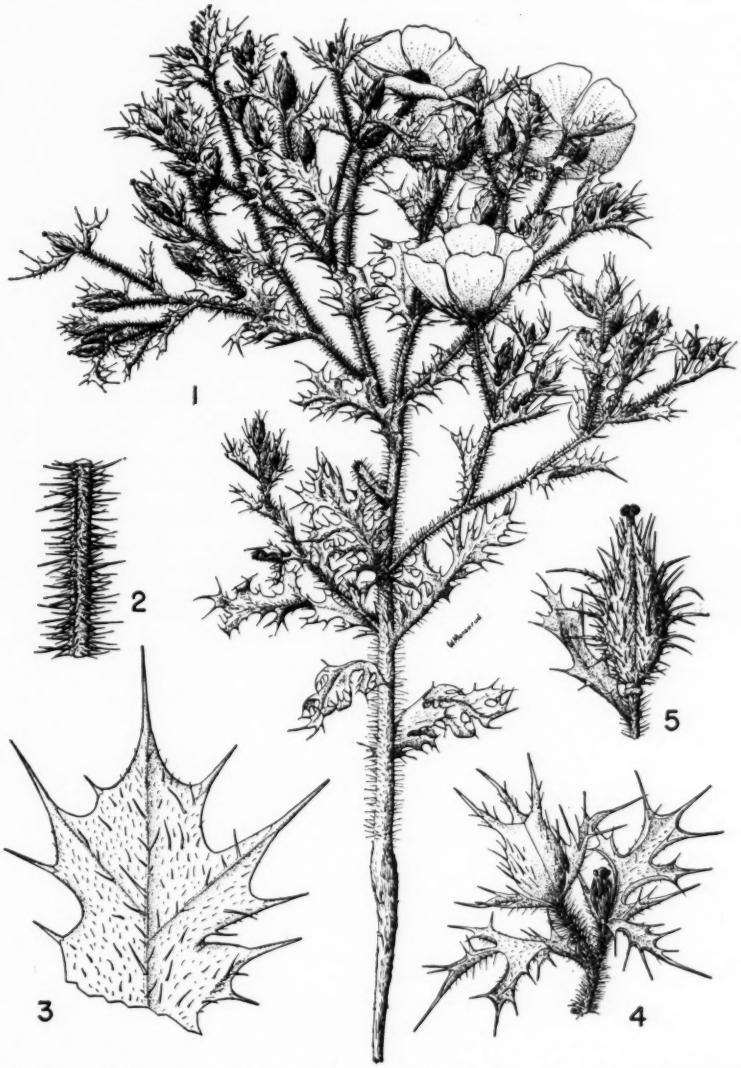

FIG. 7. *A. echinata*. 1. Habit × 3/8. Topotype, *Ownbey & Ownbey* 1408 (MIN). 2. Main stem × 1. *Stanford et al.* 280 (UC). 3. Leaf lobe, upper surface × 3. Same as 2. 4. Bud × 1. *Stanford et al.* 280 (NY). 5. Capsule × 1. Isotype, *Palmer* 208 (GH).

The distinguishing characters of *A. echinata* lie in its low stature, conspicuous prickliness of the stems, lanceolate ultimate leaf lobes and the more or less aculeate-hispid leaf surfaces. The sepal horns appear to be uniformly round in cross-section. Finally, the capsules are rather densely armed with large prickles interspersed with uneven-sized smaller ones.

A. echinata is found in its most typical state in southeastern Coahuila and adjacent Nuevo León and San Luis Potosí. Specimens collected to the north, e.g., at Múzquiz, Sabinas and Díaz (not located), at low elevations, are quite atypical, particularly in their less dense prickliness; those from Díaz, *Pringle* 8294, are coarser, more open in habit, and have larger flowers. It seems very probable that the Díaz specimens have been influenced by hybridization with another species in this area.

Specimens of *A. echinata* have been placed by previous students of the genus in either *A. platyceras* L. & O. or *A. hispida* Gray. Prain, in his monograph of *Argemone*, cites *Palmer* 19 under *A. platyceras* var. *typica* and makes it a part of "state" β of this variety. Fedde in his later monograph also cites *Palmer* 19 under *A. platyceras* proper. In treating the Mexican species of *Argemone*, Rose cites *Palmer* 19 and *Palmer* 208 as *A. hispida*. From *A. hispida* Gray, *A. echinata* differs in having stouter, more widely spaced capsule spines, in the more lanceolate ultimate leaf lobes which are tipped by a stouter spine, and in the absence of crisped indumentum on the leaf surfaces and stem. *A. echinata* differs from *A. platyceras* L. & O. in many ways, especially in the stouter capsule armature, and smaller buds, the sepal horns being round rather than laterally flattened in cross-section. In general aspect the plants are rather similar to *A. squarrosa* Greene subsp. *squarrosa*, but are smaller in stature and in all their parts.

The somatic chromosome number, 28, is the same as in *A. platyceras*, but differs from *A. squarrosa* subsp. *squarrosa* which apparently is an octaploid. The chromosome number of *A. hispida* is unknown. Other species of this alliance are all diploids with 28 somatic chromosomes except *A. aurantiaca* which apparently is a hexaploid.

Specimens examined: MEXICO.

COAHUILA

Valley near Buenavista, *Gregg s.n.* (MO, NY); valley near Saltillo, *Gregg* 95 (MO); Múzquiz, *Marsh* 20 (TEX); Sabinas, *Nelson* 6206, 6806 (F, NY, US); 2.1 miles n. of Saltillo on road to Monterrey, *Ownbey & Ownbey* 1408 (K, MEXU, MICH, MIN, SMU); Saltillo, *Palmer* 19 (GH, US); vicinity of Saltillo, *Palmer* 208 (US, holotype of *A. echinata* Ownb.; isotypes, F, GH, MO, NY, UC); Río Grande Valley near Díaz, alt. 700 ft., *Pringle* 8294 (F, GH, MEXU, MIN, MO, ND, NY, POM, RM, UC, US); Fraile, 59 km. s. of Saltillo, alt. 1967 m., *Stanford, Retherford & Northcraft* 280 (DS, MEXU, MO, NY, UC).

NUEVO LEÓN

Hacienda Pablillo, Galeana, *Taylor* 109 (DS, F, MO, RSA, TEX).

SAN LUIS POTOSÍ

Sierra de Catorce, *Rodriguez* 8 (F, US).

8. ARGEMONE SQUARROSA Greene, in Pittonia 4: 68. 1899.

Perennial with yellow latex; stems 1-several from the base, widely branched, more or less flat-topped at maturity, very densely and copiously prickly with uneven-sized prickles to moderately prickly with rather even-sized prickles; basal leaves deeply lobed, the segments oblong, the middle leaves more shallowly lobed, the uppermost distinctly clasping the stem, the margins acutely dentate, each tooth terminated by a rigid prickle, the leaf surfaces closely to moderately prickly on the main veins beneath, less so to smooth on the main veins above, the areas between the larger veins conspicuously and densely minutely aculeate-hispid to smooth above and below; buds subspherical to oblong, the body 15-20 mm. broad, 16-25 mm. long, sparingly to moderately prickly, the sepal horns more or less angular in cross-section, 8-18 mm. long, prickly, terminated by a stout, indurated spine; flowers closely subtended by 1-2 reduced leaves, 8-12 cm. in diameter; petals white; stamens 150 or more, the filaments pale yellow, the anthers yellow; stigma purple, 3-5 mm. broad, 2.0-3.5 mm. high, 4-5 lobed; capsules 4-5-carpellate, elliptical, oblong, or lance-ovate, the width, exclusive of armature, 10-18 mm., the length, including the stigma, 25-50 mm., densely to sparsely covered with basally herbaceous, spreading or reflexed spines, the largest ones usually 8-15 mm. long, these more or less prickly, the capsular surface also densely to sparingly aculeate between the large spines; seeds to 2.5 mm. long.

Lectotype: *Josephine Skehan* 79, from near Gray (now Capitan), altitude nearly 6000 ft., Lincoln Co., New Mexico, August 1898 (US; isotypes, GH, MIN, MO, ND, NY, POM, RM, UC).

Key to the subspecies:

1. Surfaces of capsules densely aculeate as well as spinescent; leaf surfaces prickly on the larger veins of both surfaces and more or less densely aculeate-hispid between the larger veins; s.e. Colorado, w. Kansas & Oklahoma, n.e. & s.e. New Mexico ..... 8a. *A. squarrosa* subsp. *squarrosa*

1. Surfaces of capsules moderately to sparingly aculeate as well as spinescent; leaf surfaces prickly on the larger veins at least beneath and smooth or very sparingly aculeate-hispid between the larger veins; w. Texas & s.e. New Mexico ..... 8b. *A. squarrosa* subsp. *glabrata*

8a. ARGEMONE SQUARROSA Greene subsp. SQUARROSA

A. squarrosa Greene, in Pittonia 4: 68. 1899; Fedde, in Pflanzenr. 4 (104): 287, 274, fig. 36Q. 1909; Woot. & Standl., Fl. N. Mex., in Contr. U. S. Nat. Herb. 19: 261. 1915; Rydb., Fl. R. Mts., p. 318. 1917; Rydb., Fl. Pr. & Pl., p. 353. 1932; Gates, Fl. Kans., p. 156. 1940; Stevens, Kans. Wild Fl., p. 116. 1948.

A. hispida Gray, Pl. Fendl., in Mem. Am. Acad. 4: 5. 1849, as to description of fruits; Brit., Man., p. 439. 1901, in part; Small, Fl. s.e. U. S., p. 462. 1903, as to Kansas distribution; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, as to Kansas distribution; Rydb., Fl. R. Mts., p. 318. 1917, as to Kansas distribution; Gates, Fl. Kans., p. 156. 1940; Stevens, Kans. Wild Fl., p. 116. 1948; not *A. hispida* Gray.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" δ Prain, l.c., p. 369, as to fruiting example of *Fendler* 16; not *A. platyceras* L. & O.

A. alba Hitch., in Contr. U. S. Nat. Herb. 3: 541. 1896; not *A. alba* Lestib.; not *A. alba* Raf.; not *A. alba* James.

A. platyceras Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, as to specimens with capsular spines "sometimes herbaceous below and again prickly down their sides"; Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; Stemen & Myers, Okla. Fl., p. 162. 1937; not *A. platyceras* L. & O.

Plants perennial by crown sprouts; latex pale yellow; stems 1-several from the base, ordinarily 3-5 (-8) dm. tall, widely branched toward the top, the primary branches few in number and surpassing the main axis, the stems at maturity more or less flat-topped, conspicuously, often densely prickly throughout, the larger prickles intergrading gradually into minute prickles; leaves bluish, the middle and upper cauline ones sessile, the uppermost ones clasping the stem, lobed, the lobes oblong, the sinuses shallow or to three-fourths or more the distance to the midrib, the lobes with lanceolate or deltoid secondary lobes, each terminated by a weak spine, the leaves prickly on the veins above and below and conspicuously, often densely minutely aculeate-hispid on the areas between the larger veins above and below; buds broadly oblong, the body 15-20 mm. broad, 20-25 mm. long, sparingly to moderately prickly, the sepal horns more or less angular in cross-section, dependent upon the amount of induration, 10-14 (-18) mm. long, prickly, terminated by a stout, indurated spine; flowers closely subtended by 1-2 reduced leaves, 8-12 cm. in diameter; petals white; stamens numerous, at least 150, the filaments pale yellow, the anthers yellow; stigma purple, 3.5-4.5 mm. wide, 2.5-3.5 mm. high, 4-5 lobed; mature capsules 4-5-carpellate, narrowly elliptical to ovate, the body, exclusive of armature, 10-18 mm. broad and 35-45 mm. long including the stigma, more or less densely covered with stout, spreading to reflexed spines, the larger spines usually 10-15 mm. long, herbaceous, provided with numerous secondary prickles for about one-half to three-fourths their length, sometimes branched, terminated by a stout, indurated point, the capsule also minutely aculeate, usually densely so, between the spines; seeds about 2.5 mm. long. (Ill.: Fig. 8, 1-3; Dist.: Fig. 13.)

Lectotype: That of the species.

Habitat and distribution: Prairies and foothills, deep, often sandy soils, western Kansas and Oklahoma, southeastern Colorado, northeastern and southeastern New Mexico, at altitudes of about 3300-6000 ft.

Flowering and fruiting dates: First flowers appear in late May and June; flowering continues through the summer and autumn until the middle of September; fruits mature from late July through September and early October.

A. squarrosa subsp. *squarrosa* appears to be closely allied to *A. hispida* with which it shares many features of gross aspect. The aculeate-hispid nature of the inter-vein surfaces of the leaves of subsp. *squarrosa* approaches that typical of *A. hispida*. This hispidity differs in being somewhat coarser in subsp. *squarrosa*. The capsular armature in *A. hispida* is fine, dense and simple; the much stouter and longer capsular spines of *A. squarrosa* subsp. *squarrosa* are sometimes branched, and are provided with secondary prickles along much of their length. Furthermore, the ultimate lobes of the leaves tend to be more lanceolate, and the terminal spines of the lobes longer and stouter in *A. squarrosa* subsp. *squarrosa*.

A. squarrosa subsp. *squarrosa* is similar to *A. aurantiaca* in stature, gross size of buds and capsules, and particularly in the armature of the

capsules. The primary spines in *A. aurantiaca* are, however, ordinarily somewhat longer and exhibit a stronger tendency toward branching than in *A. squarrosa* subsp. *squarrosa*. The two taxa differ markedly in the presence of inter-vein aculeate-hispid prickles in the latter subspecies and in the color of the latex, reddish-orange in *A. aurantiaca* and yellow in *A. squarrosa* subsp. *squarrosa*. The difference in somatic chromosome numbers between the two is also of importance, 84 in the former species and about 112 in the latter.

Although points of similarity of *A. squarrosa* subsp. *squarrosa* and other species of the complex exist, the present writer does not hesitate to accord the subspecies together with subsp. *glabrata* full specific rank.

The description of the fruits of *A. hispida* Gray, in the original diagnosis, was drawn from specimens of *A. squarrosa* subsp. *squarrosa*. With reference to the fruits, the original diagnosis of *A. hispida* reads: "The pod is covered with very strong spines, of which the larger are often branched, and also with smaller prickles and a hoary and bristly pubescence." The type collection of *A. hispida* is *Fendler* 16, from Santa Fe, New Mexico. All of Fendler's specimens from this locality are in bud and flower and are *A. hispida*. A fruiting specimen of *Fendler* 16 (MO), from "On Prairies, Upper spring of Cimaron, Aug. 27*th*, 1847" is *A. squarrosa* subsp. *squarrosa*. Gray also cites Fremont and Wislizenus as having procured *A. hispida*. *Wislizenus* 432 (MO), collected "on the Arkansas, Santa Fe road," in bud and flower, is *A. squarrosa* subsp. *squarrosa*. Fremont's collections, made enroute to California in 1845 (GH, US), which are in good fruit, are *A. squarrosa* subsp. *squarrosa;* however, a flowering and imperfectly fruiting specimen (GH), mounted with the Fremont collection is *A. hispida*. The original description of the fruits of *A. hispida* may have been drawn, in small part, from this latter specimen and to this extent the original description of the fruits of *A. hispida* may be correctly applied.

It appears that Greene took neither the material of *A. hispida* cited by Gray nor the original diagnosis of that species into account when he described *A. squarrosa*. He evidently based his description entirely upon Skehan's August, 1898, specimens from the village of Gray (now Capitan), Lincoln Co., New Mexico. In so doing, a number of specimens of the species from western Kansas and western Oklahoma, already extant in herbaria, were overlooked. *A squarrosa* subsp. *squarrosa* is still present at the type locality (*Ownbey & Ownbey* 1477).

Prain included fruiting specimens of *Fendler* 16 with his "state" ♂ of *A. platyceras* var. *typica*. It should be noted here that the central Texas material of this "state" is herein included in a new species *A. aurantiaca*.

Fruiting material of *Fendler* 16 as stated above, belongs with *A. squarrosa* subsp. *squarrosa*.

Specimens examined: UNITED STATES.

COLORADO

Baca Co.: 16.4 miles n. of Springfield (Hwy. 287), *Ownbey & Ownbey* 1705 (MIN). Bent Co.: Rule Creek, *Osterhout* 4106 (NY, RM); 4.6 miles s.e. of Las Animas (Hwy. 101), *Ownbey & Ownbey* 1668 (BM, CAS, COLO, GH, KSC, MICH, MIN, OKL, POM, RM, US, WS). Prowers Co.: 10.7 miles e. of Lamar, *Ownbey & Ownbey* 1670 (ARIZ, COLO, F, IA, ILL, K, MIN, NY, TEX, UC, UTC, US, WIS); 8.9 miles south of Lamar (Hwy. 287), *Ownbey & Ownbey* 1704 (MIN).

KANSAS

Clark Co.: no locality, *Hitchcock s.n.* (KSC). Gove Co.: no locality, *Hitchcock s.n.* (KSC). Gray Co.: no locality, *Hitchcock s.n.* (KSC). Hamilton Co.: no locality, *Hitchcock* 11 (GH, KSC, MO, NY, RM, US); 9.8 miles w. of Syracuse on road to Coolidge, *Ownbey & Ownbey* 1671 (COLO, GH, KSC, MIN, NY, OKL, RM, US); vicinity of Syracuse, *Rose & Fitch* 17022 (NY, US). Hodgeman Co., no locality, *Hitchcock s.n.* (KSC). Kearney Co.: Lakin *Broadhead s.n.* (MO). Meade Co.: no locality, *Hitchcock s.n.* (KSC). Ness Co.: no locality, *Hitchcock s.n.* (KSC). Pawnee Co.: no locality, *Hitchcock s.n.* (KSC). Rush Co.: no locality, *Hitchcock s.n.* (KSC). Stanton Co., no locality, *Hitchcock s.n.* (KSC). Trago Co.: no locality, *Hitchcock s.n.* (KSC). Wallace Co.: Fort Wallace, *Parry* 4 (MO); 0.5 mile s. of Sharon Springs, *Ownbey & Ownbey* 1674 (COLO, K, KSC, MICH, MIN, NEW MEX, OKL, RM, SMU).

NEW MEXICO

Chaves Co.: 3.5 miles n. of Dunken, *Ownbey & Ownbey* 1748 (MIN, NEW MEX, NY, POM). Eddy Co.: 21.8 miles n.w. of Carlsbad, *Ownbey & Ownbey* 1739 (BM, COLO, F, GH, MIN, NEW MEX, RM, SMU, UC, US); 4.9 miles w. of Hope, *Ownbey & Ownbey* 1747, *in part* (ARIZ, CAS, GH MICH, MIN, NEW MEX, OKL, US). Lincoln Co.: Gray, alt. 6000-6500 ft., *Earle & Earle* 179 (MIN, MO, NY, POM, RM, US); 0.6 mile s.w. of Capitan (formerly Gray), *Ownbey & Ownbey* 1477 (ARIZ, BM, COLO, F, MIN, NEW MEX); Gray, alt. nearly 6000 ft., *Skehan* 79 (US, lectotype of *A. squarrosa* Greene; isotypes, GH, MIN, MO, ND, NY, POM, RM, UC). Quay Co.: 2 miles w. of Tucumcari, alt. 4200 ft., *Castetter* 1214 (NEW MEX). Union Co.: 4.8 miles w. of Clayton (Hwy. 64 or 87), *Ownbey & Ownbey* 1661 (F, GH, MIN, NEW MEX, NY, RM, UC, US); 25.5 miles n.e. of Clayton (1.2 miles e. of Moses, Hwy. 18), *Ownbey & Ownbey* 1736 (COLO, ILL, K, MICH, MIN, NEW MEX, POM, TEX, WS).

OKLAHOMA

Cimarron Co.: 8.2 miles n. of Boise City, *Ownbey & Ownbey* 1659 (COLO, GH, MIN, NEW MEX, NY, OKL, RM, SMU, UC, US); Cimarron River crossing, 35.2 miles s. of Pritchett, Colo., *Ownbey & Ownbey* 1731 (ARIZ, BM, BRY, CAS, COLO, KSC, MIN, OKL). Texas Co.: 20.6 miles west of Guymon on road to Boise City, *Ownbey & Ownbey* 1658 (GH, MIN, OKL).

STATE UNCERTAIN

On prairies, upper spring of Cimarron, *Fendler* 16, in part (MO); no locality, Fremont's expedition to California, *Fremont* 470 or *s.n.*, *in part* (GH, US); on the Arkansas, Santa Fe road, *Wislizenus* 432 (MO).

8b. ARGEMONE SQUARROSA Greene subsp. **glabrata** G. B. Ownb., subsp. nov.

A. platyceras Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; not A. *platyceras* L. & O.

Herba perennis latice flavo. Caules 1-plures, 4-6 dm. alti, moderate vel copiose aculeati, aculeis tenuibus magnitudine regulari. Folia profunde vel repande lobata, superioribus manifeste caulem aplectentibus, subter in venis principalibus sparsissime aculeata, supra inermia vel sparsissime aculeata. Capsulae 4-5-carpellatae robuste spinescentes, spinis maximis 8-12 mm. longis, atque paucis vel multis et parvioribus spinis et aculeis interspersis. Semina usque ad 2.5 mm. longa.

Perennial with yellow latex; stems 1-several from the base, 4-6 dm. tall, widely branched in the upper portion, the branches stout, the stems at maturity more or less flat-topped, moderately to copiously prickly with slender, rather even-sized, perpendicular prickles; leaves distinctly bluish, deeply lobed below, the segments oblong, less deeply to shallowly lobed upward, the uppermost leaves distinctly clasping the stem, the margins with acute points or secondary lobes, each of which is terminated by a rigid prickle, the leaf surfaces sparingly prickly on the main veins beneath, smooth or very sparingly prickly on the main veins above, the areas between the larger veins essentially smooth both above and below; buds subspherical, the body 16-18 mm. broad, 16-20 mm. long, sparingly prickly, the sepal horns more or less angular in cross-section, 8-11 mm. long, very sparsely prickly, terminated by a rigid spine; flowers closely subtended by 1-2 reduced leaves, 8-11 cm. in diameter; petals white; stamens numerous, 150 or more, the filaments pale yellow, the anthers yellow; stigma purple, 3-4 mm. broad, 2-3 mm. high, 4-5 lobed; capsules 4-5-carpellate, oblong-elliptic to lance-ovate, the width, exclusive of armature, 14-18 mm., the length, including the stigma, 25-50 mm., armed with stout, scattered, basally herbaceous, spreading or reflexed spines, the largest spines usually 8-12 mm. long and provided with a few secondary prickles, terminated by a stout, indurated point, the capsules also provided with few to numerous very uneven-sized, smaller spines and prickles; seeds to 2.5 mm. long. (Ill.: Fig. 8, 4; Dist.: Fig. 13.)

Holotype: *Gerald B. Ownbey & Findley Ownbey* 1745, from 11.5 miles northeast of Pine Springs, Culberson Co., Texas, Aug. 11, 1953 (MIN; isotypes, GH, NY, SMU, US).

Habitat and distribution: Arid slopes and valleys, western Texas and southeastern New Mexico, at altitudes of about 2000-5000 ft.

Flowering and fruiting dates: First flowers appear in late April or early May and flowering continues as conditions permit through the summer; fruits mature from mid-June through August.

A. squarrosa subsp. *glabrata* differs from subsp. *squarrosa* principally in the amounts of surface enations present. Most of the finer prickles on the stem, buds and fruits of subsp. *squarrosa* are absent in subsp. *glabrata*. In the latter subspecies, the leaves are only sparingly prickly on the veins below, prickles are usually totally lacking on the veins above and the areas between the larger veins above and below are essentially smooth. However, occasional plants of subsp. *squarrosa* with less than the usual amount of surface enations sometimes are found in western Kansas and southeastern Colorado.

Collectors regularly have identified specimens of *A. squarrosa* subsp. *glabarata* as *A. platyceras* L. & O., with rare exceptions. Its affinity with *A. squarrosa* Greene has not been recognized previously. The relationship which this subspecies bears to the other white-flowered species found in

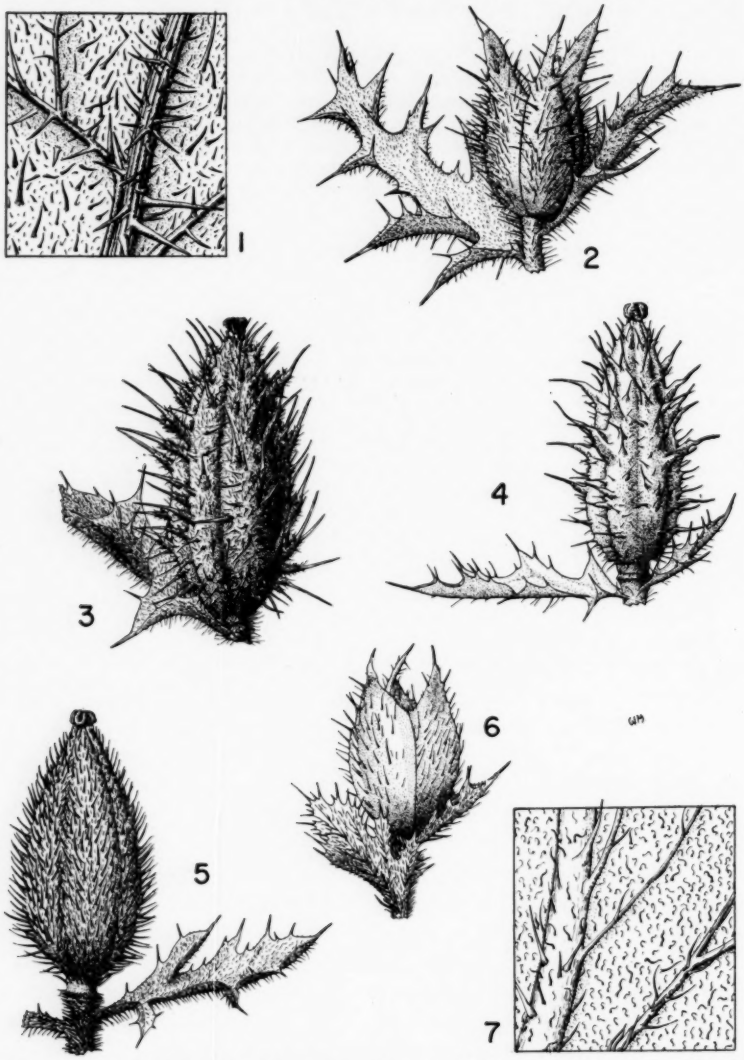

FIG. 8. 1-3. *A. squarrosa* subsp. *squarrosa*. 1. Leaf, under surface along midrib × 4. From authentic material. 2. Bud × 1. Liquid preserved material of *Ownbey & Ownbey* 1659 (MIN). 3. Capsule × 1. Liquid preserved material of *Ownbey & Ownbey* 1705 (MIN). 4. *A. squarrosa* subsp. *glabrata*. Capsule × 1. Liquid preserved material from type collection, *Ownbey & Ownbey* 1745 (MIN). 5-7. *A. hispida*. 5. Capsule × 1. Liquid preserved material of *Ownbey & Ownbey* 1697 (MIN). 6. Bud × 1. Liquid preserved material of *Ownbey & Ownbey* 1663 (MIN). 7. Leaf, under surface along midrib × 4. From authentic material.

west Texas and adjacent Mexico such as *A. chisosensis* and *A. sanguinea* needs clarification, but may well be close. No cytological or genetical evidence bearing on the question is available at present.

The geographical distribution of *A. squarrosa* subsp. *glabrata* is natural, with the exception of the records from Tom Green Co., Texas. These records possibly may represent introductions.

Specimens examined: UNITED STATES.

NEW MEXICO

Eddy Co.: Black River, dry field, *Standley* 40467 (US); Hope, *Campbell s.n.* (CAS); sandy ridges, Carlsbad Caverns, *Convis* 84 (RM); 4.9 miles w. of Hope, *Ownbey & Ownbey* 1747, *in part* (GH, MIN, NEW MEX).

TEXAS

Brewster Co.: near Alpine, *Hinckley* 578 or *s.n.* (F, NY, TEX). Culberson Co.: 1 mile s. of Pine Springs, *Ownbey & Ownbey* 1741 (ARIZ, CAS, COLO, F, MIN); 11.5 miles n.e. of Pine Springs, *Ownbey & Ownbey* 1745 (MIN, holotype of *A. squarrosa* subsp. *glabrata* Ownb.; isotypes, GH, NY, SMU, US). Dickens Co.: 4.5 miles n.e. of Spur, *Cory* 13593 (GH). Jeff Davis Co.: Fern Canyon, Davis Mts., *Cory* 9423 (GH). Presidio Co.: w. of Marfa, *Whitehouse* 11815 (SMU). Tom Green Co.: San Angelo, *Reverchon* 3707 (MO); Knickerbocker Ranch, Dove Creek, *Tweedy* 144 (US).

9. ARGEMONE HISPIDA Gray, Pl. Fend., in Mem. Am. Acad. 4: 5. 1849, excluding description of fruits.

A. hispida Walp., Ann. 2: 25. 1852; Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879, as to original citation only; Hemsl., l.c., 4: 4. 1886; Prantl & Kündig, in Engl. & Prantl, Nat. Pflanzenf. 3 (2): 141. 1889; Brit., Man., p. 439. 1901, in part; Small, Fl. s.e. U. S., p. 462. 1903, as to New Mexico distribution; Rydb., Fl. Colo., p. 149. 1906, excluding Utah distribution; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, as to Wyoming to New Mexico distribution only; Woot. & Standl., Fl. N. Mex., in Contr. U. S. Nat. Herb. 19: 261. 1915, as to New Mexico distribution; Rydb., Fl. R. Mts., p. 318. 1917, in part; Rydb., Fl. Pr. & Pl., p. 353. 1932, excluding Kansas and Utah distributions.

A. mexicana Porter, in Hayden, Rep. Geol. Surv. 1870: 473. 1871; Port. & Coult., Syn. Fl. Colo., p. 6. 1874, in part; Prantl & Kündig, in Engl. & Prantl, Nat Pflanzenf. 3 (2): 135, fig. 83B. 1889; not *A. mexicana* L.

A. mexicana var. *hispida* Torr., in Rothrock, Reports, p. 61. 1878, excluding Utah collections; not *A. mexicana* L.

A. platyceras Coult., Man., p. 13. 1885, in part; Coult., in Contr. U. S. Nat. Herb. 2: 12. 1891, as to synonym *A. hispida;* Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, in part; Weber, Hand. Pl. Colo. Fr. R., p. 106. 1953; not *A. platyceras* L. & O.

A. mexicana β *albiflora* var. *hispida* Kuntze, Rev. Gen. 1: 12. 1891, as to Wyoming distribution; not *A. mexicana* L.; not *A. albiflora* Hornem.

A. platyceras var. *hispida* Prain, in Journ. Bot. 33: 367. 1895, mainly; Eastwood, Erythea 4: 96. 1896, as to Colorado distribution; Fedde, in Pflanzenr. 4 (104): 285, in large part, 274, fig. 36P, R. 1909; Abrams, Ill. Fl., 2: 231. 1944, as to New Mexico distribution; Harringt., Man. Pl. Colo., p. 253. 1954, excluding synonym *A. squarrosa.*

A. bipinnatifida Greene, in Pittonia 3: 346. 1898.

Enomegra hispida Nels., Analyt. Key Fl. Pl. Rocky Mt. Reg., p. 27. 1902; Nels., in Bot. Gaz. 34: 366. 1902; Nels., Coult. & Nels., New Man. Bot., p. 205. 1909.

Enomegra bipinnatifida Nels., in Bot. Gaz. 34: 366. 1902.

Argemone platyceras var. *hispida* subvar. *bipinnatifida* Fedde, in Pflanzenr. 4 (104): 286. 1909; not *A. platyceras* L. & O.

Perennial, the latex white with a faint yellow cast; stems often several to many from the base, usually 3-6 dm. tall, sparingly branched towards the top, the later branches overtopping the main axis, densely prickly throughout with prickles of various sizes, and also more or less densely hispid with crisped indumentum (upon drying); leaves bluish, the upper ones sometimes shallowly lobed, the lower ones usually deeply lobed to four-fifths or more of the distance to the midrib, the lobes approximately oblong and with secondary, deltoid lobes or points, each of which is terminated by a weak prickle, the leaves often rather densely prickly on the midrib below, rather weakly prickly to unarmed on the secondary veins below and the veins above, both surfaces of the leaves also sparsely to densely minutely crisped-hispid; buds usually rather closely subtended by the foliar bracts, oblong, the body 14-18 mm. broad, 16-20 mm. long, sparsely to copiously prickly as well as hispid, the sepal horns 4-7 mm. long, usually prominently prickly, terminated by a flattened, indurated spine; flowers 7-10 cm. in diameter when fully expanded; petals white, discoloring upon drying; stamens numerous, 150 or more, the filaments pale yellow, the anthers yellow; stigma 3-4-lobed; capsules 3-4 carpellate, ovate, the width, not including the armature, 12-18 mm., the length, including the stigma, 30-40 (-50) mm., densely prickly with straight or incurved prickles, the largest of which rarely exceeds 5 mm. in length, also more or less crisped-hispid, the armature completely or nearly obscuring the surface; seeds about 2.5 mm. long. (Ill.: Fig. 8, 5-7; Dist.: Fig. 13.)

Lectotype: *Fendler* 16, *in part*, from low, sandy places around Santa Fe, New Mexico, June and July, 1847 (GH; isotypes, F, GH, MO, NY, PH, UC, US). The number *16* is that given by Gray to Fendler's collections assigned to the species. The lectotype and isotypes are of flowering material only.

Habitat and distribution: Flat prairies, slopes, and alluvial valley floors, in sandy or clay soils, foothills of the Rocky Mountains from southeastern Wyoming south through Colorado to central New Mexico at altitudes of usually 5500-7500 ft.

Flowering and fruiting dates: Flowers open from about June 1 through the summer to about Sept. 15; fruits are matured from about Aug. 1 to Sept. 20. Plants usually do not have both flowers and mature fruits simultaneously.

A. hispida is well defined morphologically and geographically. Its morphological definition rests largely upon the presence in greater or lesser density of crisped-hispid indumentum on the stem and leaves, in addition to the abundant though comparatively weak prickles of the stem. It seems to be closely related to several other species of the southwest and Mexico. It differs from *A. squarrosa* in its smaller stature and smaller, unbranched capsular spines; it differs from *A. pleiacantha* and *A. platyceras* in the presence of the indumentum described above and in size and shape of the sepal horns; it differs from *A. munita* in the fact that the surface armature of *A. munita*, when present, consists of minute prickles which are not crisped. Its geographical distribution is sympatric with no other closely related species. Much of its range is, however, also common to *A. polyanthemus* to which it probably bears no close relationship. I have observed

these two species growing together north of Ft. Collins, Colorado, and at this locality there was no evidence of natural hybridization. Probably they are completely incompatible.

The original description of *A. hispida* was based upon specimens of two species, true *A. hispida* and *A. squarrosa,* both collected by Fendler and assigned the same number, 16, by Gray. The type collection of *A. hispida,* from Santa Fe, comprised a large series of plants in bud and flower. The single specimen seen of *A. squarrosa* used in drawing up the original description of *A. hispida* came from the vicinity of the "Upper spring of Cimaron," and is in fruit. As a result of this initial confusion the original description of *A. hispida* applies in part to two species; the description of fruits applies strictly to *A. squarrosa.* When Greene described *A. squarrosa* he inadvertently supplied a name for the anomalous element in *A. hispida.* The two species are, however, persistently confused even to the present day.

The original confusion in *A. hispida* has been further compounded by later botanists by the identification of specimens of still other species as *A. hispida.* Further, the complex of species passing as *A. hispida* has often been completely merged with *A. platyceras* Link & Otto, as was done by Gray himself in his Synoptical Flora, or has been given varietal status under *A. platyceras,* as was done by Prain.

Various persons have attempted to resolve some of the difficulties creted by the excessive consolidation of biologically diverse elements described above by describing these anomalous elements as new species. This procedure has proved to be sound. The first such segregate species described was *A. munita* Dur. & Hilg. from southern California, described in 1855. This was followed by *A. bipinnatifida* Greene (1898), *A. squarrosa* Greene (1899), *A. sanguinea* Greene (1899), *A. rotundata* Rydberg (1902), *A. pleiacantha* Greene (1908), *A. aurantiaca* Ownbey and *A. echinata* Ownbey in the present paper. Of these, *A. bipinnatifida* alone falls directly into synonomy under *A. hispida,* in the restricted sense. I have not found sufficient basis to justify recognition of this proposed taxon at any rank. All of the species listed above which were described before 1909, with the exception of *A. squarrosa* which was allowed to stand, were reduced to varietal or subvarietal status or to synonomy under *A. platyceras* by Fedde in his monograph of *Argemone. A. hispida* was retained as a variety, but specimens cited under it mostly belong with one or another of the other subordinate groups recognized. Other taxa besides those mentioned above were also included in *A. platyceras* by Fedde.

A. platyceras var. *hispida* of Prain's monograph, judging from the specimens cited, consisted mainly of *A. hispida* Gray. Also cited, however, were specimens of *A. munita* subspp. *munita* and *rotundata.* Despite

Prain's arguments indicating that Durand himself ultimately decided that his *A. munita* was really synonymous with *A. hispida* Gray, both authors were undoubtedly mistaken on this point.

In Fedde's revision, *A. platyceras* var. *hispida*, as to cited specimens, consisted largely of *A. hispida* and largely of *A. munita* subsp. *rotundata*, and to a small extent of *A. munita* subsp. *munita* and *A. echinata*.

The genus *Enomegra* erected by Nelson on the basis of latex color to include *Argemone hispida* and its synonym *A. bipinnatifida* does not merit recognition. The latex is not actually white in *A. hispida* as is affirmed by Nelson, but has a faint yellow cast. Other species of *Argemone* also have whitish latex in whole or in part, for example, *A. gracilenta*, *A. munita* and *A. pleiacantha*.

Specimens examined: UNITED STATES.

COLORADO

Arapahoe Co.: Military Park, *Smith s.n.* (MO). Boulder Co.: near Boulder, alt. 5000-6000 ft., *Tweedy* 4965 (NY, RM). Chaffee Co.: Buena Vista, *Applegate* 8534 (DS). Costilla Co.: Veta Pass, alt. 2400-2700 m., *Rydberg & Vreeland* 6261 (NY, RM). Denver Co.: Barnum (Junction), *Eastwood* 119 (CAS, F, GH, MO, UC, US); along the Platte River, Denver, *Jones* 218 (MO, NY, POM, US). El Paso Co.: Colorado City, *Bacigalupi* 704 (DS, GH, UC); Colorado Springs, *Eastwood s.n.* (MIN); Manitou, *Woodward s.n.* (GH). Fremont Co.: near Canyon City, *Brandegee* 108 (MO, PH, UC). Huerfano Co.: 26.8 miles n.w. of Walsenburg, Hwy. 85, *Ownbey & Ownbey* 1487 (MIN); Huerfano Valley near Gardner, alt. 7000 ft., *Vreeland* 650 (NY, RM). Jefferson Co.: west of Wheatridge, *Bethel s.n.* (CAS); near Mt. Morrison s.w. of Denver, alt. 6000 ft., *Constance & Rollins* 1914 (UC). Larimer Co.: near Ft. Collins, *Crandall* 3 (GH); foothills, along Buckhorn Creek, *Osterhout s.n.* (MIN, RM, UC); about 25 miles n. of Ft. Collins, *Ownbey & Ownbey* 1310 (CAS, MIN, NY, UC). Las Animas Co.: 5.3 miles n.e. of Trinidad on road to La Junta, *Ownbey & Ownbey* 1663 (ARIZ, COLO, GH, MICH, MIN, NEW MEX, POM, RM, US, UTC). Otero Co.: 32.9 miles s.e. of La Junta between Bloom and Delhi, on road to Trinidad, *Ownbey & Ownbey* 1666 (COLO, GH, K, MIN, RM, UTC). Pueblo Co.: Pueblo, *Woodward s.n.* (GH). Weld Co.: New Windsor, *Osterhout* 2319 (NY, RM). County unknown: lat. 39°-41°, *Hall & Harbour s.n.* (GH).

NEW MEXICO

Colfax Co.: about 10 miles e. of Raton, alt. 6500 ft., *Robbins* 583 (UC); vicinity of Raton, *Rose & Fitch* 17560 (US). Mora Co.: 1.9 miles s.w. of Wagon Mound, *Ownbey & Ownbey* 1484 (COLO, MIN, NEW MEX, OKL, UTC). San Miguel Co.: Canyon Bonito, Las Vegas, alt. 2300 m., *Arsé* 19222 (F). Santa Fe Co.: near Santa Fe, *Fendler* 16, *in part* (GH, lectotype of *A. hispida* Gray; isotypes, F, GH, MO, NY, PH, UC, US); Santa Fe, alt. 7200 ft., *Heller & Heller* 3704 (DS, GH, KANU, KSC, MIN, MO, ND, NY, US); Santa Fe, *Rusby* 20 (TEX, US). Taos Co.: near Gusdorf, *O'Byrne & Magner* 3417-4 (MO). Union Co.: 1.4 miles w. of Des Moines, *Ownbey & Ownbey* 1662 (MIN); near the Sierra Grande, alt. 2100-2925 m., *Standley* 6052 (US).

WYOMING

Albany Co.: Sybille (i.e., Sibylee) Hills, *Nelson* 314 (ND, holotype of A. bipinnatifida Greene; isotypes, GH, MIN, MO, RM, US); Chug (i.e., Chugwater) Creek, *Nelson* 7344 (GH, MIN, MO, NY, POM, RM, US); 34.6 miles s.w. of Wheatland, Hwy. 34,

Ownbey & Ownbey 1500 (ARIZ, COLO, KSC, MIN, SMU); Sherman Hill, alt. 8000 ft., *Williams* 1059 (CAS, GH, MO, NY, RM). Laramie Co.: Cheyenne *Overton* 105X (RM). Platte Co.: Chugwater station, *Buffum* 46 (RM); Wheatland, *Nelson* 286 (NY).

STATE UNCERTAIN

Fremont's expedition to California, *Fremont* 8 (GH).

10. ARGEMONE MUNITA Dur. & Hilg., in Journ, Acad. Nat. Sci. Phila., series 2, 3: 37. 1854; Dur. & Hilg., in Pac. R. Rep. 5 (3): 5, t. 1. 1855.

Annual or perennial with pale lemon-yellow, rarely more intensely yellow latex; stems 1-10 (-25), 4-16 dm. tall, often purplish (except in subsp. *argentea*), sparingly to copiously branched, sparingly prickly (in subsp. *robusta*) to moderately prickly (in subsp. *munita*) to rather closely or densely prickly (in subspp. *rotundata* & *argentea*); leaves oblanceolate below, progressively elliptical to ovate or lanceolate upward, the uppermost usually partially clasping the stem; lower leaves lobed to about one-half the distance to the midrib or less, the lobes usually manifestly rounded at the apex, sometimes angular, the middle and upper leaves usually more shallowly lobed or the margins sharply angular; leaf margins armed with prickles, less closely so in subspp. *robusta* and *munita*, more closely so in subspp. *rotundata* and *argentea;* leaf surfaces very sparingly prickly only on the main veins (mostly beneath, in subsp. *robusta*), sparingly prickly on the veins and intervein surfaces (in subsp. *munita*), more copiously prickly on the veins and intervein surfaces (in subsp. *argentea*) to often densely prickly (in subsp. *rotundata*); buds oblong, elliptic-oblong or oblong-obovate, the body 10-16 mm. broad, 12-22 mm. long, prickly with perpendicular prickles, sparingly so (in subspp. *robusta* and *munita*) to copiously prickly with simple prickles (in subsp. *argentea*) or copiously prickly with the larger prickles sometimes compound (in subsp. *rotundata*), the sepal horns usually terete, or sometimes somewhat flattened or angular in cross-section, 6-8 (4-10) mm. long, smooth to densely prickly, the apical spine often enlarged and flattened at its juncture with the vegetative basal portion of the horn (especially in subsp. *rotundata*); flowers 5-10 (-13) cm. in diameter when fully expanded, the nearest subtending foliar bract often separated by several mm. from the base of the flower; petals white, obcuneate to obovate; stamens numerous, about 150-250 or more, the filaments pale yellow, the anthers yellow; stigma purple, 3-5 lobed, about 2-4 mm. wide, 2.0-3.5 mm. high; style evident, usually less than 2 mm. long in fruit; capsules 3-5-carpellate, at maturity ovate, elliptical, elliptic-lanceolate or lanceolate, the width, excluding the armature, 9-15 (-18) mm., the length, including the stigma and style, 35-55 mm., armed with mostly large, widely spaced spines (in subsp. *robusta*), these interspersed with a few lesser spines and prickles (in subsp. *munita*) or interspersed with numerous lesser spines and prickles (especially in subsp. *rotundata*, less so in subsp. *argentea*), the longest spines seldom exceeding 8 mm. in length, the capsular surface clearly visible through the armature (in subsp. *robusta*) to much obscured (in subsp. *rotundata*); seeds 1.8-2.2 (-2.6) mm. long.

Lectotype: *A. L. Heermann, s.n.*, from Williamson's Pass,[1] Los Angeles

[1] The exact location of Williamson's Pass is given by W. P. Blake in Pac. R. R. Rept. 5 (2): 67. 1857 (i.e., Williamson's Report), as follows: "The position of this pass, and its direction, will be seen upon the general map and on the geological map of Tejon and vicinity, Map II, Chapter XV. The pass extends from the Great Basin to the Rancho of San Francisquito, which is in one of the valleys of the Pacific slope. Its entrance on the Great Basin is near the meridian 118° and latitude 34° 30′, and its direction a little south of west; the distance through the mountains from the Great Basin side to the open valley of the Santa Clara river is about 20 miles. The altitude of the summit level is 3,164 feet above the sea." The maps mentioned by Blake are, first, "General Map of Explorations and Surveys in California" to be found in Vol. 11 of the Reports. The pass in question is termed New Pass on this map, but the elevation and

Co., California, date not given (PH; isotype, P, not seen, Durand Herbarium, according to Prain, 1895, p. 368).

Habitat and distribution: Deserts, foothills, and mountain slopes to middle elevations, northern Baja California to northern California, northwestern New Mexico, Nevada and Utah.

Flowering and fruiting dates: See under the subspecies.

A specimen of *Argemone* collected by Dr. A. L. Heermann at Williamson's Pass, California, is on deposit at the Philadelphia Academy. It is undoubtedly part of the original collection of the species, and in my opinion should be designated the lectotype. The lectotype consists of two fragments of branches, each with one flower. The stems are rather coarsely and evenly prickly with scattered prickles of about 3-6 mm. in length, and are otherwise glabrous. Portions of four leaves are present. These are marginally prickly and with a few lesser prickles on the veins of both surfaces and are otherwise glabrous. One bud is present; it is subspherical, the body about 14 mm. broad and 17 mm. long, the sepal horns about 9 mm. long. The sepals are sparsely prickly, mostly distally and on the un-indurated basal portion of the horns, with prickles about 3 mm. long standing about perpendicular to the surface. The flowers are white and about 9 cm. in diameter. The young fruits are evenly long-prickly with straight prickles which presumably would be quite widely scattered over the capsular surface at maturity.

Dr. Prain (1895) under *A. platyceras* var. *hispida* cites a fragment of *Argemone* collected at Williamson's Pass in California by Heermann and deposited in Durand's herbarium at Paris. Despite Prain's arguments that Durand himself ultimately decided that his species, as represented by this Paris specimen, was synonymous with *A. hispida* Gray, there is no doubt that both Prain and Durand were mistaken on this point.

Since the Heermann fragment at Paris is stated by Prain to be hispid, I cannot avoid the thought that this specimen, which I have not seen, may well represent an intermediate between subsp. *munita* and subsp. *rotundata*. The same holds true to some extent for the lectotype, although its surface armature is very much in the direction of the taxon I am designating as subsp. *munita*. The original illustration of *A. munita* shows a plant with far more prickly stems than I would consider typical for subsp. *munita* as herein circumscribed.

The determination of the lectotype of this species as possibly inter-

location are correct for Williamson's Pass and they doubtless are the same. The other map mentioned by Blake is a part of his own paper in Vol. 5 of the Reports, facing p. 196. Here the pass is designated Williamson's Pass. The latitude and longtitude given by Blake can be located on detailed topographic maps of the present day. The town of Vincent at Long. 118° 7′ and Lat. 34° 30′ and an altitude of 3210 feet lies within the pass. The type locality of *A. munita* Dur. & Hilg. is in this vicinity.

mediate between two included subspecies, viz. subspp. *munita* and *rotundata,* creates certain difficulties concerning which subspecies should include the lectotype. I can find nothing in the International Rules covering this situation. In the present instance I am arbitrarily classifying the lectotype with the more glabrous subspecies which it more closely resembles. It automatically becomes the type of this subspecies as well as that of the species in the broad sense. This has added advantages, since subsp. *rotundata* already has a type, that of *A. rotundata* Rydb. No new names are needed and only one new combination is required if this procedure is adopted.

A. munita subspp. *robusta* and *rotundata* represent the morphological extremes of the species. They are connected through subsp. *munita* by transitional forms. Subsp. *argentea* is a component of the species which occupies a position outside the above series. Its closest presumed affinities are with subsp. *rotundata.*

Since *A. munita* is a highly variable species including plants ranging from densely hispid to nearly smooth, its precise definition is difficult. The tendency towards rather short and broad, apically rounded, leaf lobes is evident in each subspecies. The indurated apical spine of the sepal horn tends to be flattened and enlarged at its juncture with the vegetative lower part of the horn, especially in subsp. *rotundata.* Subspp. *argentea* and *rotundata* are perennials, subsp. *munita* annual or perennial, and subsp. *robusta* annual. Were it not for the intergrading forms between subspp. *munita* and *rotundata,* I would be inclined to separate *A. munita* into two species, *A. munita,* in the strict sense, composed of two subspecies, *munita* and *robusta,* and *A. rotundata,* composed of two subspecies, *rotundata* and *argentea.* It is known from my own work that the haploid number of chromosomes in *A. munita,* all four subspecies, is 14. This in itself, however, provides no evidence for or against treating the complex as a single species or as two species. No experimental crosses among the four subspecies have been attempted.

In literature, *A. platyceras* L. & O., in the broad sense, has usually included, among other diverse elements, the three taxa which I designate as *A. munita* subsp. *munita, A. munita* subsp. *robusta,* and *A. munita* subsp. *argentea. A. platyceras* var. *hispida* (Gray) Prain, in literature, includes true *A. hispida* Gray combined, in most cases, with *A. munita* subsp. *rotundata.* When American authors have accorded *A. hispida* Gray specific rank it has been in the above sense, i.e., with the inclusion of *A. munita* subsp. *rotundata.* These viewpoints can no longer be sustained. For further discussion see the treatments of *A. hispida* and *A. platyceras* in this paper.

In his study of California *Argemone* species, Carl B. Wolf (1938) made an excellent disposition of the California specimens of *A. munita* available to him. All specimens were placed, with misgivings, under the traditional names *A. platyceras* L. & O. and *A. platyceras* var. *hispida* (Gray) Prain. Many specimens were classified as intermediate between the two. My circumscription of *A. munita* subsp. *munita* is equivalent to Wolf's *A. platyceras* except that I have restricted the taxon to the less prickly forms and have removed entirely specimens of two new subspecies, viz., subsp. *argentea* and subsp. *robusta*, with a consequent contraction of the distributional range. My circumscription of *A. munita* subsp. *rotundata* is equivalent to Wolf's *A. platyceras* var. *hispida* except that I have allowed for slightly more variation in this taxon than did Wolf. Intermediacy of numerous specimens between subspp. *munita* and *rotundata* was recognized by Wolf, and in most instances where specimens were so annotated by Wolf I concur fully with his viewpoint.

A marked relationship between fire and germination of the seeds of *A. munita* is evident. *A. munita* subsp. *robusta* was abundant in a recently burned area and nowhere else, at the type locality in Orange Co., Calif., when the writer visited the site in 1954. A large population of plants determined as intermediates between subspp. *munita* and *rotundata* were seen on another burn located 7 miles west of Ravenna, Los Angeles Co., Calif., by the writer, also in 1954. A very vigorous population of about 200 individuals, all of the current season, of *A. munita* subsp. *munita*, was seen on a new burn situated 1.6 miles s.w. of Emory store, just east of Palomar Mt., San Diego Co., Calif., by the writer, again in 1954. Good germination of the seeds of the last subspecies was obtained by personnel of the Rancho Santa Ana Botanic Garden when vegetable material was burned on the surface of the flats just after planting of the seeds. The increased germination of the seeds of many western plants obtained by heat treatments is well known.

Key to the subspecies of *A. munita:*

1. Stems rather sparingly to moderately prickly, i.e., with usually 0-80 prickles per sq. cm. on the stem about 5 cm. below the base of the capsule which terminates the primary axis; buds very sparingly to moderately prickly; leaf surfaces smooth or sparingly prickly on the veins and intervein surfaces; capsules distantly to more closely spinescent, the surface clearly visible.

2. Stems very sparingly prickly, i.e., with usually 0-10 prickles per sq. cm. on the stem about 5 cm. below the base of the capsule which terminates the primary axis; buds very sparingly prickly; leaf surfaces usually totally smooth above, sparingly prickly only on the main veins beneath; capsular armature consisting almost wholly of large, widely spaced spines; Orange Co., California ..... 10a. *A. munita* subsp. *robusta*

2. Stems and buds more copiously prickly; leaves somewhat prickly on the veins of

both surfaces and usually also between the veins; capsular armature consisting of large spines interspersed with uneven-sized smaller ones.

3. Stems with about 10-30 prickles per sq. cm. about 5 cm. below the base of the capsule which terminates the primary axis; leaf surfaces sparingly to moderately prickly on the veins and usually on the intervein surfaces; coast ranges, northern Baja California and southern California ..... 10b. *A. munita* subsp. *munita*

3. Stems with about 50-80 prickles per sq. cm. about 5 cm. below the base of the capsule which terminates the primary axis; leaf surfaces moderately to rather copiously prickly, but not densely so on the veins and intervein surfaces; primarily in the coast ranges of California ..... 10d. Intermediates between subspp. *munita* and *rotundata*

1. Stems more closely prickly, i.e., with usually 80-500 prickles per sq. cm. on the stem about 5 cm. below the base of the capsule which terminates the primary axis; buds usually closely prickly; leaf surfaces moderately to closely prickly on the veins and intervein surfaces; capsules usually copiously armed with large spines interspersed with smaller, uneven-sized spines and prickles, the surface partially obscured.

4. Stems glaucous, when alive usually with purplish coloration, usually closely armed with uneven-sized, perpendicular prickles of moderate length; buds usually closely beset with large, often compound, perpendicular prickles interspersed with smaller, uneven-sized simple ones.

5. Stems with about 80-180 prickles per sq. cm. about 5 cm. below the base of the capsule which terminates the primary axis; prickles of the buds always simple; generally less copiously prickly throughout than subsp. *rotundata;* primarily in the coast ranges of California ..... 10d. Intermediates between subspp. *munita* and *rotundata*

5. Stems usually with about 120-500 prickles per sq. cm. about 5 cm. below the base of the capsule which terminates the primary axis; largest prickles of buds sometimes compound; mainly on the eastern slopes of the Sierra Nevada, California, to Utah ..... 10c. *A. munita* subsp. *rotundata*

4. Stems glaucous, greenish-white when alive, lacking purplish coloration, usually closely armed with very long, uneven-sized, perpendicular prickles, i.e., with about 100-300 prickles per sq. cm. about 5 cm. below the base of the capsule which terminates the primary axis; buds usually closely beset with simple, slender, more equal-sized ascending prickles; desert ranges of southern California, Death Valley, adjacent Arizona and southern Nevada ..... 10e. *A. munita* subsp. *argentea*

10a. ARGEMONE MUNITA Dur. & Hilg. subsp. **robusta** G. B. Ownb., subsp. nov.

A. platyceras Munz, Man. S. Calif. Bot., p. 182. 1935, in small part; Wolf, in Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 60. 1938, in small part; not *A. platyceras* L. & O.

Herba annua latice citreo-flavo. Caules 5-16 dm. alti, sparse aculeati. Folia glauca, foliis terminalibus amplexicaulibus, subter sparsissime aculeata in venis, supra inermia. Alabastra sparsissime aculeata, aculeis perpendicularibus, petalis albis; staminibus circa 250. Capsulae 3-4-carpellatae, ellipticae vel elliptico-lanceolatae spinis sparsis armatae. Semina circa 2.5 mm. longa.

Coarse annual with lemon-yellow latex; stems 1, 5-16 dm. tall, branched in the upper one-half, sparsely prickly with stout, perpendicular prickles, often tinged with purple; lower leaves to 3 dm. long, oblanceolate, not clasping, shallowly lobed; middle and upper leaves progressively smaller, lobed to about one-half the distance to the midrib, the uppermost ovate and clasping the stem; all the leaves fleshy in texture when fresh, glaucous, the margins toothed, each tooth terminated by a prickle, the lower surfaces armed with a very few prickles on the midrib and larger secondary veins, the upper surfaces usually totally smooth; buds slightly longer than broad, the width 12-16 mm., the length 14-22 mm., very sparingly prickly with perpendicular prickles, the sepal horns

slender, somewhat flattened, 6-8 mm. long, smooth; flowers 6-10 cm. in diameter, usually not closely subtended by the much reduced bracteate uppermost leaves; petals white, broadly obcuneate to obovate; stamens often 250 or more, the anthers yellow, the filaments lemon-yellow; stigma purple, 3-4-lobed, about 2-3 mm. wide and 2 mm. high; style evident in fruit; capsules 3-4-carpellate, elliptical to elliptic-lanceolate, the width, not including the armature, 10-18 mm., the length, including the stigma, 35-50 mm., armed with scattered, mostly subequal, often reflexed spines the largest of which are 6-8 mm. long, the capsular surface clearly visible through the armature; seeds about 2.5 mm. long. (Ill.: Fig. 10, 4-5; Dist.: Fig. 13.)

Holotype: *Carl B. Wolf* 5403, collected on the summit of Santiago Peak, Santa Ana Mts., at an elevation of 5680 feet, Orange Co., California, Aug. 24, 1933 (UC; isotypes, CAS, DS, RSA, US).

Habitat and distribution: Dry, rocky soil, arid, sunny slopes, Santa Ana Mts., Orange Co., Calif., at elevations of about 5000 to 5680 ft.

Flowering and fruiting dates: Flowers first appear about June 15 and continue to open through the summer; fruits mature from about July 15 until autumn.

This subspecies is distinguished by its stout, sparingly prickly, annual stems, its thick, fleshy leaves which are only sparingly prickly beneath and mostly totally smooth above, by the clasping upper leaves, by the large, open inflorescences, and by the capsule armature which consists almost wholly of large, widely-spaced spines.

In my opinion, *A. munita* subsp. *robusta* is suffiicently well marked to justify recognition. However, it does intergrade with subsp. *munita* and may be considered to be the smoothest aspect of a series of forms leading through subsp. *munita* to subsp. *rotundata*. The similarity of this subspecies with some populations of *A. pleiacantha* subsp. *ambigua* is very close. The relationships of these two taxa have not been sufficiently investigated.

All of the type material of subsp. *robusta* is in fruit. An ample series of plants in bud, flower and all stages of fruit was collected by my wife and myself at the type locality in 1954. The accompanying description is drawn largely from these latter specimens.

Specimens examined: UNITED STATES.

CALIFORNIA

Orange Co.: between Modjeska Peak and Santiago Peak, alt. ca. 5000 ft., *Ownbey & Ownbey* 2177 (ARIZ, BM, BRY, CAS, COLO, DAO, F, GH, ILL, K, MEXU, MICH, MIN, MO, NEW MEX, NY, RM, RSA, SMU, TEX, UC, UTC, US, WS); summit of Santiago Peak, Santa Ana Mts., alt. 5680 ft., *Wolf* 5403 (UC, holotype of *A. munita* Dur. & Hilg. subsp. *robusta* Ownb.; isotypes, CAS, DS, RSA, US); main divide motorway between Santiago Peak and Modjeska Peak, Santa Ana Mts., alt. ca. 5400 ft., *Wolf* 9382 (CAS, DS, RSA, UC, US).

10b. ARGEMONE MUNITA Dur. and Hilg. subsp. MUNITA

A. munita Dur. & Hilg., in Journ. Acad. Nat. Sci. Phila., series 2, 3: 37. 1854; Dur. & Hilg., in Pac. R. Rep. 5 (3): 5, t. 1. 1855; Mueller, in Walp., Ann. 4: 170. 1857; Mueller, l.c., 7: 85. 1868.

A. platyceras Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, in part; Eastwood, in Erythea 4: 96. 1896, in large part; Hall, Bot. Surv. San Jac. Mt., p. 81. 1902; Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; Jeps., Fl. Calif. 1: 560. 1922, in part, as to California; Jeps., Man. Fl. Pl. Calif., p. 399. 1925, in part, as to California; Munz, Man. S. Calif. Bot., p. 182. 1935, in part, as to California; Wolf, in Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 60. 1938, in large part; Abrams, Ill. Fl., 2: 231. 1944, in part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" β Prain, l.c., p. 368, in part; not *A. platyceras* L. & O.

A. platyceras var. *hispida* Prain, l.c., p. 367, in part; Fedde, in Pflanzenr. 4 (104): 285. 1909, in part; Davids. & Moxl., Fl. S. Calif., p. 146. 1923, in part; Abrams, Fl. Los Ang., p. 162. 1904, in part; not *A. platyceras* L. & O.; not *A. hispida* Gray.

A. intermedia Fedde, in Pflanzenr. 4 (104): 281. 1909, in part; not *A. intermedia* Sweet.

Annual or perennial with pale lemon-yellow latex; stems 1-10, 6-15 dm. tall, usually purplish, sparingly to moderately prickly; basal leaves to about 3 dm. long, usually much smaller, all the leaves more or less lobed, the lobes often not manifestly rounded, sparingly prickly at the margin and on the larger veins and often also on the intervein surfaces both above and below; buds oblong-obovate, the body about 12-16 mm. wide and 16-20 (-22) mm. long, sparingly to moderately prickly with simple, perpendicular prickles, the sepal horns terete, 6-8 (-10) mm. long, with scattered prickles at the base and terminated by a spine which is slightly flattened at its juncture with the vegetative basal portion of the horn; flowers 7-10 (-13) cm. in diameter, the subtending foliar bracts often distant; petals white, obovate to obcuneate; stamens numerous, about 150 (-250); stigma purple, 3-5-lobed, about 3-4 mm. wide and high; style often evident, to 2 mm. long; capsules 3-5-carpellate, when mature, narrowly to broadly elliptical or elliptic-ovate, the width, excluding the armature, 9-12 (-14) mm., the length, including the stigma and style, 25-40 (-45) mm., moderately spinescent with spreading spines, the largest of which are 5-8 mm. long, and also commonly with a few lesser spines and prickles, the capsular surface clearly visible through the armature; seeds 2.0-2.2 mm. long. (Ill.: Fig. 9, 1-4; Dist.: Fig. 13.)

Lectotype: That of the species.

Habitat and distribution: Dry foothills and slopes, northern Baja California northward in the Coast Ranges of California to San Luis Obispo Co., frequently in granitic soils, at altitudes of about 250-6000 ft., but most commonly from 1500 to 4500 ft.

Flowering and fruiting dates: Flowering begins about April 1 at lowest elevations but not until May or June at higher elevations, and continues until July 15 or later; early fruits reach maturity by about June 1 and fruits continue to ripen through the summer and fall.

A. munita subsp. *munita* is moderately prickly throughout with erect prickles; the prickliness of the leaf surfaces is sparse; smaller prickles are usually found interspersed with the larger spines on the capsules. The leaves often have the characteristic lobing of subsp. *rotundata* and subsp. *robusta*, but in many plants the lobes are narrower and less manifestly rounded at the apex. Transition forms to both subspp. *rotundata* and *robusta* do occur, and variation from the smoothest phase in subsp. *robusta* to the most prickly phase in subsp. *rotundata* is continuous. Mixed popu-

lations of subsp. *munita* and forms approaching typical subsp. *rotundata* are not infrequent in Los Angeles Co. For further discussion of this point see the discussion of intermediates following the treatment of subsp. *rotundata*.

Many of the collections of subsp. *munita* from Baja California are quite

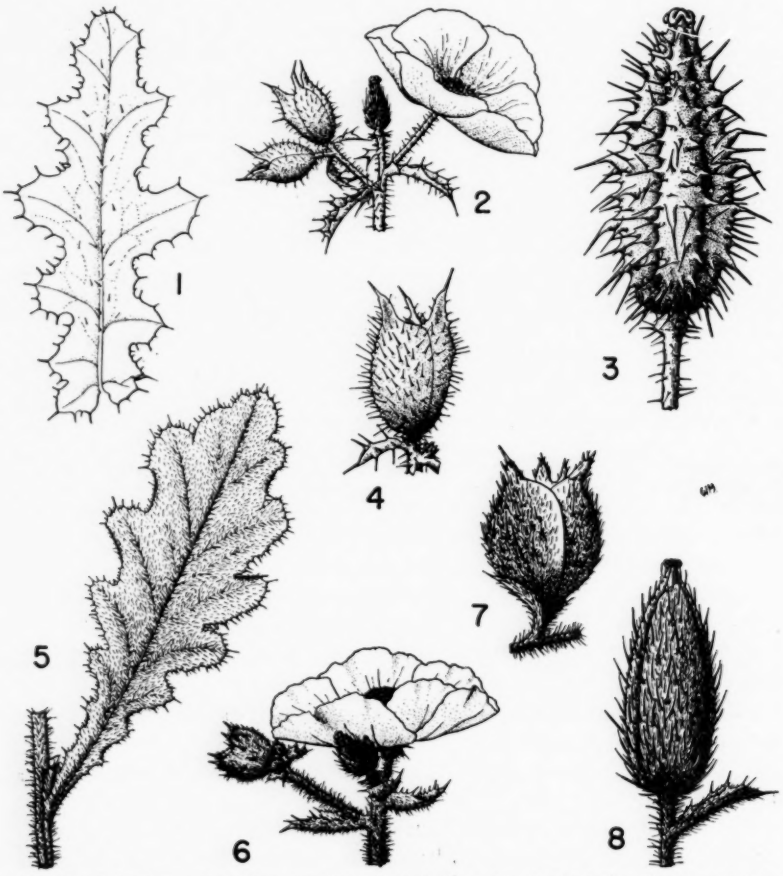

FIG. 9. 1-4. *A. munita* subsp. *munita*. 1. Middle cauline leaf × ½. *Ownbey & Ownbey* 2174 (MIN). 2. Habit × ½. Liquid preserved material of *Ownbey & Ownbey* 2174 (MIN). 3. Capsule × 1. Same as 2. 4. Bud × 1. Same as 2. 5-8. *A. munita* subsp. *rotundata*. 5. Lower surface of leaf × ½. *Lee* 720 (UC). 6. Habit × ½. Liquid preserved material of *Ownbey & Ownbey* 2179 (MIN). 7. Bud × 1. *Jones s.n.* 1897 (GH). 8. Capsule × 1. *Lee* 75 (UC).

prickly for this subspecies, but their inclusion here seems more feasible than alternative possibilities.

In Prain's monograph of *Argemone*, *A. munita* subsp. *munita* is partly included under his *A. platyceras* var. *typica* "state" β, and partly under his var. *hispida* of the same species. These are only two of the many distinct taxa included under *A. platyceras*, in the broad sense, and for a more complete enumeration of these taxa the reader should turn to the discussion of *A. platyceras* in this paper. Similarly, Fedde, in his revision, cited specimens belonging to this taxon under *A. platyceras* proper along with many other anomalous elements.

Specimens examined: UNITED STATES.

CALIFORNIA

Los Angeles Co.: Roscoe, *Eastwood* 26d (CAS); Acton, *Elmer* 3721, *in part* (MIN, NY); Mint Canyon, *Epling s.n.* (MO); Williamson's Pass, *Heermann s.n.* (PH, lectotype of *A. munita* Dur. & Hilg.); road up to Mt. Wilson from La Canada, *Jackson s.n.* (CAS); near Pasadena, *McClatchie s.n.* (NY). Riverside Co.: Idyllwild road, San Jacinto Mts., alt. 3500 ft., *Ewan* 3587 (RM); San Jacinto, *Hasse* 5664 (F, MIN, NY); Hamilton Creek, s.e. part of San Jacinto Mts., alt. 4500 ft., *Munz & Balls* 17964 (RSA); 2.8 miles s.e. of Palm Springs, *Ownbey & Ownbey* 2112 (CAS, MIN, RSA, UC, US); 0.1 mile w. of Radec, alt. 1695 ft., *Ownbey & Ownbey* 2170 (CAS, COLO, MICH, MIN, NY, POM, RM, UC, UTC, most plants possibly evidencing influences of subsp. *rotundata*); 13.2 miles s.e. of Idyllwild, Hemet Valley, alt. ca. 4500 ft., *Ownbey & Ownbey* 2178b (BM, BRY, CAS, COLO, F, GH, K, MIN, NY, POM, RM, UC, UTC, US, WS); n.w. of Dripping Springs near Temecula, *Peirson* 6015 (RSA). San Bernardino Co.: Redlands, *Woodruff s.n.* (NY). San Diego Co.: Cottonwood valley, *Abrams* 3548 (DS, F, GH, MO, NY, US); San Felipe, *Brandegee s.n.* (UC); Laguna Mts., *Brandegee s.n.* (UC); e. of Palomar Mt., *Fiker* 3657 (UC); 1.6 miles s.w. of Emory store, just e. of Palomar Mt., *Ownbey & Ownbey* 2171 (ARIZ, BM, BRY, CAS, COLO, DAO, F, GH, ILL, K, MEXU, MICH, MIN, NEW MEX, NY, OKL, RM, RSA, SMU, TEX, UC, UTC, US, WIS, WS); 3.5 miles n.e. of Laguna Jct., *Ownbey & Ownbey* 2174 (ARIZ, CAS, COLO, GH, MIN, POM, UC, UTC, US); 4 miles w. of Jacumba, alt. 3460 ft., *Wolf* 2276 (CAS, DS, GH, RSA). Santa Barbara Co.: valley of the Sisquoc River, *Baker s.n.* (UC); Cuyama, Green Canyon, *Eastwood s.n.* (GH, UC, US); Sisquoc River near Santa Maria, *Sinsheimer s.n.* (CAS). San Luis Obispo Co.: 2.5 miles s. of Round Top, Sec. 31, T. 31 S., R. 14 E., *Lee* 642 (UC). Ventura Co.: s. side of Mt. Pinos, alt. 5800 ft., *Hall* 6504 (UC); above Matilija dam, Ventura River basin, *Pollard s.n.* (CAS, RSA). County uncertain: *Fremont s.n.* (GH).

MEXICO.

BAJA CALIFORNIA

San Fernando, *Anthony s.n.* (UC); Aliso, *Brandegee s.n.* (UC); 13 km. n.w. of Rancho Mesquital *Carter, Alexander & Kellogg* 1897 (DS, UC, US); Socorro, *Orcutt s.n.* (MO); La Grulla, *Orcutt s.n.* (UC); 8.4 miles s. of Santo Tomás, *Ownbey* 2066 (MIN); Rosario Wash, *Wiggins* 5242 (CAS, DS, GH, NY, RM, UC, US); along Río Santo Domingo about 6 miles above the Mission, *Wiggins & Demaree* 4797 (DS, GH, NY, POM, UC, US); small canyon e. of the summit, 5 miles w. of Ojos Negros, *Wiggins & Gillespie* 4075 (CAS, DS, F, GH, MO, NY, POM, RSA, US).

10c. ARGEMONE MUNITA Dur. & Hilg. subsp. **rotundata** (Rydb.) G. B. Ownb., stat. nov.

A. rotundata Rydb., in Bull. Torr. Bot. Club 29: 160. 1902; Rydb., Fl. R. Mts., p. 318. 1917.

A. hispida Torrey, in Stansb., Exped. Val. Great Salt Lake, p. 383. 1852; Durand, Sketch Bot. Great Salt Lake, in Trans. Am. Phil. Soc. 11: 158. 1860; Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879, as to Utah distribution only; Brew. & Wats., Bot. Calif., ed. 2, 1: 21. 1880; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, as to Utah distribution only; Rydb., Fl. R. Mts., p. 318. 1917, as to Utah distribution; Tidestr., Fl. Utah & Nev., in Contr. U. S. Nat. Herb. 25: 216. 1925, as to Utah & Nevada distribution; Garrett, Sp. Fl. Wasatch, ed. 5, p. 79. 1936; Peck, Man. Pl. Oregon, p. 321. 1941; not *A. hispida* Gray.

A. mexicana Torrey, in Pac. R. Rep. 5 (2) 359. 1857; not *A. mexicana* L.

A. mexicana var. *hispida* Wats., in King, U. S. Geol. Expl. Fort. Paral. 5: 13. 1871, excluding synonyms; Coulter, in Hayden, Rep. Geol. Surv. 1872: 759. 1873; not *A. mexicana* L.; not *A. hispida* Gray.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in small part; not *A. platyceras* L. & O.

A. platyceras var. *hispida* Prain, l.c., in part; Eastwood, in Erythea 4: 96. 1896, as to California distribution; Abrams, Fl. Los Ang., p. 162. 1904, in part; Fedde, in Pflanzenr. 4 (104): 285. 1909, in large part; Jeps., Fl. Calif. 1: 560. 1922; Davids. & Moxl., Fl. S. Calif., p. 146. 1923, in part; Jeps., Man. Fl. Pl. Calif., p. 400. 1925; Wolf, Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 61. 1938; Abrams, Ill. Fl., 2: 231. 1944, as to California and the Great Basin distributions; not *A. platyceras* L. & O.; not *A. hispida* Gray.

A. platyceras Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; Munz, Man. S. Calif. Bot., p. 182. 1935, in part, as to California; Abrams, Ill., Fl., 2: 231. 1944, in part; Clokey, Fl. Charles. Mts., p. 92. 1951, as to the Charleston Mts. distribution; not *A. playtceras* L. & O.

A. platyceras var. *hispida* subvar. *rotundata* Fedde, in Pflanzenr. 4 (104): 286. 1909; not *A. platyceras* L. & O.; not *A. hispida* Gray.

A. platyceras var. *hispida* subvar. *subintegra* Fedde, l.c.; not *A. platyceras* L. & O.; not *A. hispida* Gray.

A. intermedia var. *corymbosa* Jeps., Fl. Calif. 1: fig. 116. 1922, as to figure only; not *A. intermedia* Sweet; not *A. corymbosa* Greene.

Perennial with pale lemon to yellow latex; stems 1-10 (-25), 4-10 dm. tall, often purplish, moderately to densely prickly throughout (very rarely almost smooth) with uneven-sized prickles, the smallest prickles not crisped; leaves lobed, sometimes barely so, the lobes often broadly oblong and with a tendency to be rounded at the apex, marginally prickly and also more or less densely prickly above and below on the veins and intervein surfaces (very rarely almost smooth), the smallest prickles not crisped; buds oblong, 10-16 mm. broad, 14-20 mm. long, usually copiously prickly, the larger prickles often compound, i.e., with smaller secondary prickles from near the base, the sepal horns 5-8 (-10) mm. long, usually very prickly, terminated by a stout indurated spine which is generally enlarged and flattened at its juncture with the vegetative basal portion of the horn; flowers 7-12 cm. broad, the first subtending foliar bracts often several mm. distant; petals white, obovate to obcuneate; stamens 150 or more; stigmas purple, 3-5-lobed, about 3-4 mm. wide and 2.5-3.5 mm. high; capsules 3-5-carpellate, when mature, ovate to narrowly elliptical, the width, excluding the armature, 12-16 (-18) mm., the length, including the stigma and style, 30-55 mm., usually densely armed with straight or slightly incurved, usually simple spines, the largest of which seldom exceed 8 mm. in length and these occasionally with slender secondary prickles from near the base, the large spines interspersed with smaller to minute spines and prickles, the armature partially obscuring the capsular surface; seeds about 2.0-2.2 mm. broad and 2.2-2.6 mm. long. (Ill.: Fig. 9, 5-8; Dist.: Fig. 13.)

Holotype: *Sereno Watson* 47, collected in the Diamond Mountains, Nevada, alt. 6000 ft., July, 1868 (NY).

Habitat and distribution: Sandy or gravelly soil, dry, open desert slopes and foothills, low to middle elevations (mostly 4000-8500 ft.), San Bernardino Mts., southern California northward along the eastern slopes of the Sierra Nevada to Shasta Co., and localized in the coast ranges in Lake and Colusa Counties, California; northwestern Arizona and widespread in the western half of Utah, and in Nevada.

Flowering and fruiting dates: First flowers appear about May 1 in the southern parts of its range; flowering continues to about Sept. 15; fruits are matured from about July 15 to Oct. 15.

The holotype of *A. munita* subsp. *rotundata* is in the last stages of disintegration. Enough remains, however, of the leaves, stem and one bud to determine its identity beyond question. It is mounted on the same sheet as *Watson* 49, in part, from Utah Valley, Utah, which is also somewhat broken and fragmented, but which represents the same subspecies and is the only other specimen cited by Rydberg in his original diagnosis. The type has definitely rounded leaf lobes, doubtless the basis for the name, and represents an extreme expression of this tendency. The over-all prickliness of the type is also somewhat less than is found in many specimens of the subspecies from farther west. I believe that Rydberg was fully justified in describing this plant as new, since the application of the name *A. munita* Dur. & Hilg. was clouded. Further, it appeared that the leaf shape could be given considerable weight in distinguishing his species from the more westerly material which I place in the same subspecies. This position is, however, no longer tenable since individual plants in which a tendency toward rounded leaf lobes is strongly expressed are not uncommon throughout the subspecies range.

The distinguishing morphological characters of *A. munita* subsp. *rotundata* were clearly set forth by Rydberg in his original description. The most pronounced ones are: commonly quite closely prickly on both leaf surfaces, but lacking the finest, crisped surface indumentum characteristic of *A. hispida;* the tendency toward the leaf lobes to be rounded at the apex; and the ordinarily very prickly sepals.

The holotype of *A. platyceras* var. *hispida* subvar. *subintegra* Fedde, *Torrey* 10, from near Empire City, Nevada, the only collection cited in the original description, is on deposit at the Gray Herbarium. Two isotypes are at the New York Botanical Garden. The type consists of a single stem in bud, flower and early fruit. It is mounted with another specimen bearing the hand-written notation "Nevada: Dr. Anderson." Examination of the type and isotypes of this proposed subvariety makes evident that it is typical *A. munita* subsp. *rotundata* in all respects. The leaf shape upon

which it is based, falls well within the usual limits of variation for this subspecies.

Forms of *A. munita* subsp. *rotundata* which are less prickly than usual for the subspecies are found at several localities in Nevada. The most extreme example is a collection from the Toiyabe Mts. (*Linsdale & Linsdale* 474) which is essentially smooth except for prickles terminating the angles of the leaf margins. Plants classified as typical subsp. *rotundata* as well as plants intermediate in armature also occur in the Toiyabe Mts.

Specimens examined: UNITED STATES.

ARIZONA

Coconino Co.: Hermit Trail, Grand Canyon, *Eastwood* 5862 (CAS); same loc., *Eastwood* 5862a (CAS, GH); Nagle's Ranch (Kaibab Plateau), alt. 7600 ft., *Jones* 6054d (POM, US); near Flagstaff, alt. 1900 m., *Leiberg* 5872 (DS, US); Jacob Lake, Kaibab Plateau, *Mead* 670 (US); 14.1 miles e. of Jacob Lake in vicinity of House Rock, *Ownbey & Ownbey* 1816 (ARIZ, COLO, GH, MIN, RM, UC, UTC, US); 25.6 miles e. of Grand Canyon (village) on road to Cameron, *Ownbey & Ownbey* 1820 (MIN). Mohave Co.: 20.2 miles s.w. of Kingman, alt. ca. 1800 ft., *Ownbey & Ownbey* 2167 (ARIZ, GH, MIN, NY, RSA); Hualapai Mts., *Stephens s.n.* (UC).

CALIFORNIA

Alpine Co.: along Carson-Markleeville Highway at state line, alt. 5000 ft., *Lee* 75 (UC); Markleeville, alt. 5500 ft., *Rose s.n.* (CAS); West Carson Canyon, alt. 6000 ft., *Yates* 3993 (UC). Colusa Co.: 1 mile e. of Mill Creek Ranger Station, alt. 1800 ft., *Constance* 2490 (CAS, DS, GH, MEXU, MIN, MO, NY, POM, RM, RSA, UC). Inyo Co.: near Independence, *Campbell s.n.* (CAS); desert slopes, lower end of Onion Valley on road to Independence, alt. 8900 ft., *Ferris* 9014 (DS, UC); Owens Valley, *Hastings s.n.* (NY); hills w. of Bigpine, *Heller* 8258 (CAS, DS, F, GH, KSC, MO, NY, US); Panamint City, Surprise Canyon, Panamint Mts., alt. 7000 ft., *Howell* 4001 (CAS); Division Creek, alt. 7000 ft., *Kerr s.n.* (CAS); Gray's Meadows, *Kerr s.n.* (CAS); s.e. base of Olancha Peak, *Straw* 683 (MIN, RSA); Sawmill Canyon, Sierras n. of Independence, alt. 5000 ft., *Train* 746 (US); Cottonwood Creek, alt. 7500 ft., *Wolf* 3244 (CAS, DS, GH, RSA). Kern Co.: near Onyx on the Walker Pass road, *Abrams* 11941 (DS, POM, UC); Kernville, *Brandegee s.n.* (UC); Caliente Creek, Huckleberry Canyon, *Brandegee s.n.* (UC); Tehachapi Mts., vicinity of Bisses Station, *Dudley* 432 (DS, NY, US); Havilah, *Grinnell* 367 (US); Walker Pass, *MacFadden* 13602 (NY); Chimney Meadow, Sec. 8, T. 24 S., R. 37 E., alt. 6000 ft., *St. John* 254 (UC); 4-5 miles s. of Tehachapi, alt. 5000 ft., *Wolf* 2189 (DS, RSA); near Monolith, Piute Mts., alt. 3800-4400 ft., *Zigmond* 6 (F). Lake Co.: north fork of Cache Creek, *Blankinship s.n.* (GH); Snow Mt., alt. 6000 ft., *Blankinship s.n.* (MO); on Eel River, 1 mile below Hullville, *Heller* 6043 (F, GH, MO, NY, UC, US); Bartlett Creek at foot of grade over Bartlett Mt., *Hoover* 3807 (UC); near Bartlett Springs, *Howell* 21210 (CAS); South Fork of the Eel River, *Jepson s.n.* (ND, UC). Lassen Co.: hills near Susanville, *Austin* 1328 (US); Milford, *Baker s.n.* (UC); near Susanville, *Eastwood & Howell* 8337 (CAS); Honey Lake, *Howell* 638 (CAS); plain in Long Valley, alt. 4500 ft., *Leiberg* 5228 (US); Doyle, *Monnet* 945 (CAS). Los Angeles Co.: Mescal Creek, San Gabriel Mts., alt. 5000 ft., *Ewan* 9934 (GH); Blue Ridge, San Gabriel Mts., alt. 8000-8500 ft., *Howell* 23416 (CAS). Mono Co.: 4.4 miles e. of Sonora Pass, alt. 7500 ft., *Albertus* 382 (UC); 2.6 miles n.w. of Rock Creek, alt. 6500 ft., *Balls & Everett* 18048 (RSA); Mono Lake, *Bolander s.n.* (GH, US); desert near Mono Lake, alt. 6450 ft., *Brewer* 1828 (US); foot of Bloody Canyon, *Chestnut & Drew s.n.* (UC); near Fales Hot Springs, alt. 7500 ft., *Constance* 2445 (GH, NY, RM, UC); 4.6 miles n.w. of Bridgeport, alt. 6700 ft.,

Graham 196 (UC); mouth of Buckeye Canyon, alt. 7000 ft., *Hendrix* 474 (UC); Mono Lake, *Jones* 24933 (GH, MO, NY, POM); 6 miles s. of Coleville, alt. 5500 ft., *Lamm* 15884 (RM); foothills near Goose Lake, *McLean s.n.* (UC); Mono Pass, *McLean s.n.* (UC); Lundy, alt. 8000-9000 ft., *Minthorn s.n.* (UC); Devil's Gate, alt. 7600 ft., *Peterson* 595 (UC); east slope of Sonora Pass, alt. 5000 ft., *Rowntree s.n.* (CAS); along Swager Creek, 9 miles n.w. of Bridgeport, alt. 6800 ft., *Wolf* 5319 (CAS, DS, POM, RSA, UC, US). Plumas Co.: n.w. end of Sierra Valley, alt. 5100 ft., *Hanks* 11 (UC); Mohawk, *Raphael s.n.* (CAS). San Benito Co.: New Idria, *Brewer* 768, *in part* (MO, UC, US). San Bernardino Co.: Lytle Creek canyon, alt. 4000 ft., *Abrams* 2692 (DS, NY, POM); Horse Springs, Kingston Mts., alt. 4200 ft., *Abrams* 14164 (DS, GH); near Coliseum Mine, Clark Mt., alt. 4800 ft., *Alexander* 479 (UC); 1.5 miles n.w. of mouth of Deep Creek, alt. 2950 ft., *Axelrod* 520 (UC); Lytle Creek canyon, alt. 4500 ft., *Hall* 1428 (UC); Johnson Grade, just n. of Baldwin Lake, alt. ca. 6900 ft., *Ownbey & Ownbey* 2129 (MIN, NY, RM, RSA, UC); 2.0 miles w. of Cajon Junction, *Ownbey & Ownbey* 2168 (ARIZ, BM, BRY, CAS, COLO, DAO, F, GH, ILL, K, MEXU, MICH, MIN, NEW MEX, NY, POM, RM, SMU, TEX, UTC, US, WIS, WS); hills near San Bernardino, *Parish s.n.* (NY); Hesperia, alt. 3100 ft., *Spencer* 420 (GH, NY, POM); San Bernardino Mts., *Vasey* 16 (F); Clark Mt., 0.5 mile n.w. of Coliseum Mine, alt. 5000 ft., *Wolf* 9599 (RSA, UC); Horse Thief Spring, Kingston Mts., alt. 4768 ft., *Wolf* 9694 (RSA, UC). Shasta Co.: stage road near Hat Creek, *Baker* 391 (UC); west of Fall River Mills, *Cantelow* 1048 (CAS); Pitt River Canyon, *Eastwood* 1055 (CAS). Sierra Co.: Loyalton, *Eastwood* 7825 (CAS, US); 3.8 miles s.e. of Dog Valley, alt. 5000 ft., *Nordstrom* 937 (UC); road to Reno near inspection station, *Schreiber* 883 (UC). Tulare Co.: Kern Flats, *Baker* 4556 (coll. by Culbertson) (GH, MO, ND, POM).

Nevada

Churchill Co.: East Gate, alt. 5100 ft., *Allen* 363 (DS, NY); same loc., *Allen* 364 (MO). Clark Co.: near Cold Creek, Charleston Mts., alt. 6000 ft., *Burt* 2 (UC); Charleston Park, Charleston Mts., alt. 2270 m., *Clokey* 5472 (CAS, F, GH, ND, NY, RM, RSA, UC, US); Kyle Canyon, Charleston Mts., alt. 2100 m., *Clokey* 7927 (DS, F, GH, KSC, MIN, MO, ND, NY, POM, RM, RSA, TEX, US). Douglas Co.: between Carson and Smith valleys, *Lehenbauer* 138 (NY). Elko Co.: 10 miles n. of Ruby Valley Store, *Holmgren* 1256 (NY, UC). Esmeralda Co.: Tule Canyon, south of Lida, alt. 1500 m., *Tidestrom* 9821 (MO). Lander Co.: Big Creek, Toiyabe Mts., *Linsdale & Linsdale* 331 (CAS); Birch Creek, Toiyabe Mts., *Linsdale & Linsdale* 474, 475 (CAS), less prickly form. Lincoln Co.: near Utah line e. of Panaca, *Eastwood & Howell* 7313 (CAS); Mormon Mts., alt. 3000-6000 ft., *Kennedy & Goodding* 109 (NY, UC, US); 9.5 miles w. of Caliente, alt. ca. 6500 ft., *McVaugh* 5982 (UC); Pioche, alt. 6500 ft., *Minthorn s.n.* (UC); Caliente, alt. 1320 m., *Tidestrom* 9535 (NY, US). Lyon Co.: 2 miles e. of Dayton, *Goodner & Henning* 80 (MO); Smith Valley, *Haley s.n.* (CAS). Mineral Co.: Corey Canyon, Wassuk Mts., alt. 1600 m., *Tidestrom* 10077 (NY). Nye Co.: Grime's ranch near Monitor Range, alt. 1820 m., *Tidestrom* 10986 (US). Ormsby Co.: Eagle Valley near Carson, alt. 1446 m., *Baker* 1090 (GH, MO, ND, NY, POM, RM, UC, US); near Empire City, *Torrey* 10 (GH, holotype of *A. platyceras* var. *hispida* subvar. *subintegra* Fedde; isotype, NY). Storey Co.: near Virginia City, *Bloomer s.n.* (US); Geiger Grade to Virginia City, *Eastwood* 14824 (CAS). Washoe Co.: Reno, alt. 5500 ft., *Jones s.n.* (DS, GH, POM, US); 1 mile w. of Steamboat Springs, *McVaugh* 6135 (UC); 8 miles n. of Poeville, alt. 5250 ft., *Tillotson* 109 (UC). White Pine Co.: Warm Springs, *King s.n.* (CAS); 18.6 miles n.w. of Ely on U. S. Hwy. 50, *McVaugh* 6104 (UC); mesa w. of Baker, alt. 1950 m., *Tidestrom* 11137 (MO). County uncertain: Diamond Mts., alt. 6000 ft., *Watson* 47 (NY, holotype of *A. rotundata* Rydb.); Pah-Ute Mts., alt. 5000 ft., *Watson* 49, in part (US).

Utah

Beaver Co.: 4 miles s. of Minersville, Mineral Mt., *Harris* C29212 (MIN, UC); Milford, alt. 5000 ft., *Jones* 1605 (NY, POM). Box Elder Co.: foothills e. of Brigham,

Zundel 212 (DS, NY). Davis Co.: Farmington Canyon, *Garrett* 7641 (KANU). Iron Co.: Cedar City, alt. 6000 ft., *Ballow s.n.* (DS, RM). Juab Co.: Juab, *Goodding* 1055 (GH, MO, NY, POM, RM, UC, US). Kane Co.: mouth of Clear Creek Canyon, Zion National Park, alt. 5700 ft., *Boyle* z152 (UC). Millard Co.: 7 miles s. of Kanosh, alt. 5450 ft., *Barkley & Reed* 4039 (GH, NY, POM). Piute Co.: Marysvale, alt. 6000 ft., *Jones* 5388a (NY, UC, US); along Sevier River below Marysvale, *Rydberg & Carlton* 6975 (NY, RM, US). Salt Lake Co.: near Salt Lake City, *Garrett* 1824 (RM); Bacchus, *Jones s.n.* (UC). Sanpete Co.: Manti, alt. 6000 ft., *Jones* 5516 (MO, POM, US); near Ephraim, alt. 1650 m., *Tidestrom* 140 (US). Sevier Co.: Clear Creek Canyon, *Garrett* 2516 (NY); Glenwood, alt. 5300 ft., *Ward* 189 (US). Tooele Co.: Grantsville, *Garrett* 2765 (GH). Utah Co.: Santaquin, *Eastwood & Howell* 580 (CAS); Lehi, *Jones* 99 (GH); Lehi, *Jones s.n.* (UC); Utah Valley, alt. 5000 ft., *Watson s.n., in part* (NY). Washington Co.: near Sugar Loaf Butte, St. George, *Degener & Peiler* 16396 (RM); Diamond Valley, 11 miles n. of St. George, alt. 3500 ft., *Gould* 1799 (GH, NY, UC, US); 10 miles e. of Leeds, *Hitchcock* 3035 (UC); 20 miles n.e. of St. George, alt. 4000 ft., *McKelvey* 4186 (GH); Leeds, *Tidestrom* 9400 (GH, NY, US). Weber Co.: Ogden Canyon, Ogden, alt. 5000-6000 ft., *Pammel & Blackwood* 3752 (CAS, GH, MO).

10d. Argemone munita Dur. & Hilg. subsp. munita X A. munita subsp. rotundata (Rydb.) Ownb.

A. munita Greene, Fl. Franc., p. 281. 1892.

A. platyceras Wolf, in Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 60. 1938, in small part; not *A. platyceras* L. & O.

A. platyceras var. *hispida* Bower., Fl. Pl. Mt. Diablo, p. 151. 1944; not *A. platyceras* L. & O.; not *A. hispida* Gray.

Transitional forms between subsp. *munita* and subsp. *rotundata* create the greatest taxonomic difficulties. No attempt is made herein to assign true intermediates to any subspecies and no nomenclatorial category designed to include these intermediates is proposed since both alternatives are unsound and, practically speaking, appear impossible. Some statements concerning the distributional relationships of subspp. *munita* and *rotundata* and their intermediates may be made, however, with some assurance. Subsp. *munita* is found in northern Baja California and along the coastal ranges of southern California as far north as San Luis Obispo County. Subsp. *rotundata* is found from the San Bernardino and San Gabriel mountains northward along the eastern slopes of the Sierra Nevada where it reaches its most typical state, to Shasta and Lassen Counties, California. It occurs eastward across the southern two-thirds of Nevada and the western half of Utah at intermediate elevations. Outlying occurrences of nearly typical subsp. *rotundata* are in Lake and Colusa Counties, and in San Benito County, California.

Distributionally, subsp. *rotundata* impinges upon subsp. *munita* in the San Bernardino and San Gabriel Mts. of southern California. Commonly in this area and along the coastal ranges northward in California more or less intermediate forms occur (Dist.: Fig. 13). It is postulated that at least part of these intermediates, especially those from western Riverside, western San Bernardino, and Los Angeles Counties are hybrid derivatives

of the two subspecies. The series of intergrading forms found here is continuous, and the morphological characters of the two subspecies are recombined to varying degrees. Mixed populations containing individuals which would be classified as subsp. *munita* and other individuals which would be classified as intermediates or which approach subsp. *rotundata* are not uncommon. Very detailed analyses of representative natural populations of *A. munita* from the above area in field, garden and laboratory are needed in order to clarify the picture. It is certain that genetic factors not now understood are influencing the variability of this species.

Specimens examined of intermediate character between *A. munita* subsp. *munita* and *A. munita* subsp. *rotundata:* UNITED STATES.

CALIFORNIA

Contra Costa Co.: Mitchell Canyon, Mt. Diablo, *Bowerman* 1603 (UC). Fresno Co.: White Creek, Sec. 25, T. 19 S., R. 13 E., alt. 1600 ft., *Johannsen* 67 (UC). Kern Co.: Ft. Tejon, alt. 3200 ft., *Abrams & McGregor* 279 (DS, NY, US); Ft. Tejon, *Horn s.n.* (NY, US); Rosamond, *Weston s.n.* (CAS). Los Angeles Co.: Bouquet Canyon, alt. 600 m., *Clokey, Clokey & Templeton* 4614 (UC); Acton, *Elmer* 3721, *in part* (GH, MO, POM, US); Bald Flat on Blue Ridge, San Gabriel Mts., alt. 8300 ft., *Ewan* 10024 (GH); San Francisquito Canyon, *MacFadden* 72E (RM, UC); 14 miles s. of Vincent on road to La Canada, *Ownbey & Ownbey* 2116, *in part* (MIN, RSA, UC); Soledad Canyon, 7 miles w. of Ravenna, *Ownbey & Ownbey* 2118 (BM, BRY, CAS, COLO, F, GH, MIN, RM, RSA, SMU, UC, WS); San Francisquito Canyon, 8.8 miles n. of Saugus, *Ownbey & Ownbey* 2121 (CAS, GH, MIN, RSA, UC, US); 1.9 miles s.e. of Valyermo P. O., *Ownbey & Ownbey* 2122 (MIN, NY, POM, UTC); one-half way between Castaic and Sandberg, Libre Mts., *Wolf* 2184 (DS, RSA, US). Riverside Co.: between Beaumont & Riverside, *Winblad s.n.* (CAS). San Benito Co.: New Idria, *Brewer* 768, in part (GH, US); San Benito, *Eastwood* 6926 (CAS). San Bernardino Co.: head of Clark's Grade, San Bernardino Mts., alt. 7700 ft., *Munz* 10583 (POM, UC); San Bernardino, alt. 1000-2500 ft., *Parish* 4684 *or* 4784 (DS, NY, US); foothills of San Bernardino Mts., *Parish & Parish* 128 (DS, NY, US). San Diego Co.: Hell Hole Canyon near Borego, *Epling & Robison s.n.* (DS, MO, NY); Jacumba Hot Springs near Monument 233, *Schoemfeldt* 3256 (US). Santa Barbara Co.: Bates Canyon, Sec. 18, T. 10 N., R. 28 W., alt. 3200 ft., *French* 783 (UC); Cuyama Valley, Sec. 18, T. 9 N., R. 24 W., alt. 2800 ft., *Sowder* 410 (UC). Stanislaus Co.: Arroyo del Puerto, Mt. Hamilton Range, alt. 1350 ft., *Sharsmith* 3776 (DS, UC). Tehama Co.: burned area, mountains, alt. 800 ft., *Bertin s.n.* (CAS). Ventura Co.: upper Sespe Creek n. of Wheeler's Hot Springs, alt. 3500 ft., *Munz* 13223, 13233 (POM, UC).

10e. ARGEMONE MUNITA Dur. & Hillg. subsp. **argentea** G. B. Ownb., subsp. nov.

A. platyceras Coville, Bot. Death Valley Exped., in Contr. U. S. Nat. Herb. 4: 59. 1893; Eastwood, in Erythea 4: 96. 1896, in small part; Jeps., Fl. Calif. 1: 560. 1922, in part, as to California; Jeps., Man. Fl. Pl. Calif., p. 399. 1925, in part, as to California; Munz, Man. S. Calif. Bot., p. 182. 1935, in part, as to California; Wolf, in Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 60. 1938, in small part; not *A. platyceras* L. & O.

Herba perennis. Caules 1-15 vel plus, fruticosissimi, longis et tenuibus aculeis dense muniti. Folia inferiora lobata, lobis circiter tam latis quam longis, apice rotundata, marginibus dense dentatis, superficibus plerumque aculeis longis et patentibus munitis. Alabastra elliptico-oblonga aculeatissima. Flores 5-8 cm. diametro, petalis albis, sta-

minibus circa 200. Capsulae 3 (-5) -carpellatae, elliptico-lanceolatae vel lanceolatae, multis spinis magnitudine inaequali et aculeis armatae. Semina 1.8-2.2 mm. longa.

Perennial with very pale lemon-yellow, nearly white, latex; stems 1-15 or more from the base, 4-8 dm. tall, very bushy, often copiously branched, mostly closely armed with long, slender, perpendicular prickles, greenish-white throughout; leaves very glaucous, oblanceolate below to progressively elliptical to ovate-lanceolate upward, the uppermost partially clasping the stem, the lowermost to about 2 dm. long, lobed to about one-half or more of the distance to the midrib, the lobes rounded apically, about as broad as long, the sinuses narrow, the middle and upper leaves progressively more shallowly lobed, the uppermost often very shallowly and irregularly lobed, the leaf margins irregularly dentate, the teeth mostly close set and each terminated by a stout prickle, both surfaces of the leaves usually copiously armed with long, spreading prickles; buds elliptic-oblong, 10-15 mm. wide, 12-18 mm. long, copiously beset with slender, simple, ascending prickles, the sepal horns terete in cross-section, 4-6 (-10) mm. long including the terminal spine, prickly; flowers 5-8 cm. in diameter when fully expanded, often separated by several mm. from the nearest subtending foliar bract; petals white, obcuneate to obovate; stamens numerous, about 200 or more, about equalling the pistil in length at anthesis, the anthers yellow, the filaments lemon-yellow; stigma purple, about 2.5-3.0 mm. wide and 2.0-2.5 mm. high, usually 3 (-5) -lobed; style evident in fruit, 1-2 mm. long; capsules usually 3 (-5) -carpellate, elliptic-lanceolate to lanceolate, the width, exclusive of spines, 10-14 mm., the length, including the stigma and style, 25-35 mm., the armature consisting of numerous uneven-sized spines and prickles, the longest of which is about 6-8 mm., the capsular surface partially obscured; seeds about 1.8-2.2 mm. long. (Ill.: Fig. 10, 1-3; Dist.: Fig. 13.)

Holotype: *Ownbey & Ownbey* 2113, collected 0.5 mile s.w. of Beal Well, Chocolate Mts., Imperial Co., Calif., May 22, 1954 (MIN; isotypes, ARIZ, BM, BRY, CAS, COLO, F, GH, K, MICH, MIN, MO, NEW MEX, NY, RM, RSA, SMU, UC, UTC, US, WS).

Habitat and distribution: Along washes, sandy or decomposed granitic soils, in and adjacent to the dry desert mountain ranges of southern California, Death Valley and adjacent Arizona and southern Nevada, at altitudes of 1500 ft. or less in the south to 3000 ft. or more in the north.

Flowering and fruiting dates: First flowers appear about March 1, the last in late May or early June; fruits mature from about April 15 to July 15, but in greatest abundance in late May and June.

Plants of this subspecies are usually copiously prickly on the stems with long, slender, perpendicular prickles. The long prickles are interspersed with comparatively few minute prickles. The prickles of the buds are ascending, simple, and comparatively soft; the sepal horns usually are short and broad at the base. These and other features lead me to believe that subsp. *argentea* is sufficiently distinct from subsp. *rotundata* to merit taxonomic recognition. The geographical distributions of the two are completely disjunct; subsp. *argentea* grows in more arid habitats at low elevations. The possibility of genetic interchange between migrant individuals of the two taxa, however, still exists.

A. munita subsp. *argentea* is abundant at Beal Well and for a few miles along the road through the pass southwestward towards Niland. The plants

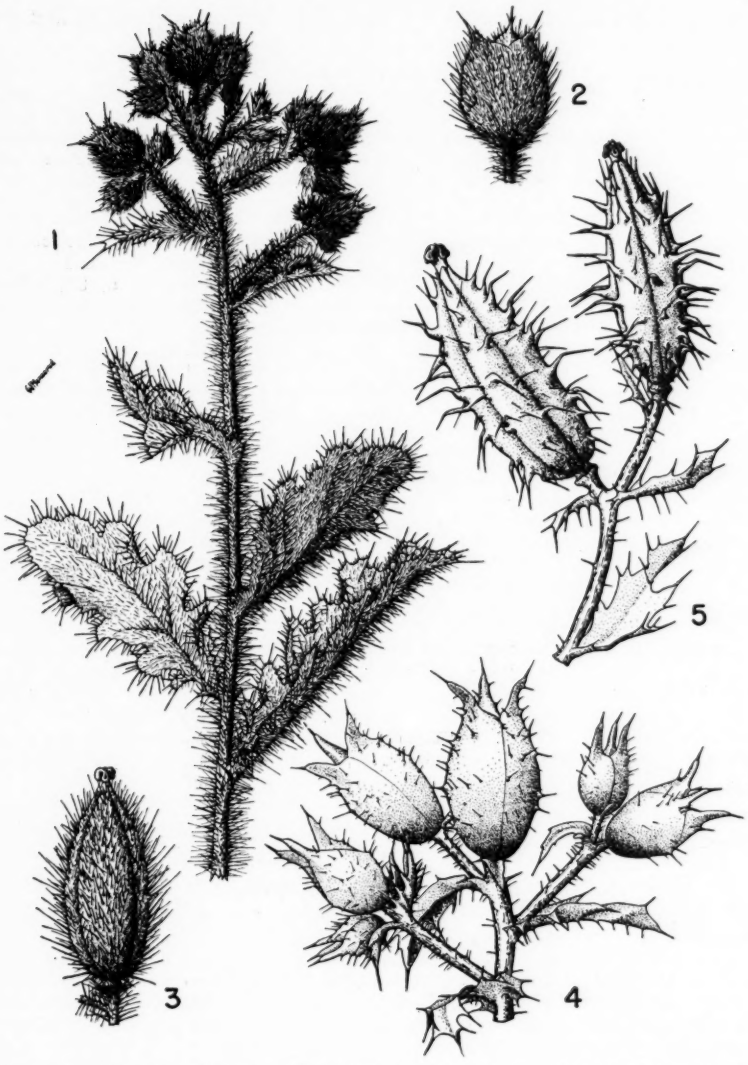

FIG. 10. 1-3. *A. munita* subsp. *argentea*. 1. Habit × ½. *Ownbey & Ownbey* 2073 (MIN). 2. Bud × 1. Same as 1. 3. Capsule × 1. Holotype, *Ownbey & Ownbey* 2113 (MIN). 4-5. *A. munita* subsp. *robusta*. 4. Buds × 1. Liquid preserved material of topotype, *Ownbey & Ownbey* 2177 (MIN). 5. Capsules × 1. Same as 4.

in this area are most typical of the subspecies as I understand it, and for this reason I have chosen Beal Well as the type locality.

Specimens examined: UNITED STATES.

ARIZONA

Mohave Co.: foot of Needles, Colorado River, *Grinnell s.n.* (UC). County uncertain: spring near Pierce's Ferry alt. 1700 ft., *Jones* 5077a (POM); near mouth of Bill Williams Creek, *MacDougal* 26 (NY).

CALIFORNIA

Imperial Co.: between Chuckwalla Well and Niland, Colorado Desert, alt. ca. 850 ft., *Jaeger* 819 (US); Beal Well, *Munz* 11940 (POM, UC); 12 miles e. of Niland on road to Beal Well, *Ownbey* 2073 (GH, IA, ILL, IND, KSC, MIN, NY, OKL, US, WIS); 0.5 mile s.w. of Beal Well, Chocolate Mts., *Ownbey & Ownbey* 2113 (MIN, holotype of *A. munita* Dur. & Hilg. subsp. *argentea* Ownb.; isotypes, ARIZ, BM, BRY, CAS, COLO, F, GH, K, MICH, MIN, MO, NEW MEX, NY, RM, RSA, SMU, UC, UTC, US, WS); "Fort Yuma, Cal.," *Thomas s.n.* (NY); 8.7 miles n.e. of Niland on road to Beal Well and Blythe, *Wiggins* 9619 (DS, GH, UC); 13 miles from Niland on road to Beal Well, alt. 600 ft., *Wolf* 1876 (DS, RSA, UC). Inyo Co.: canyon near Darwin Falls, Argus Mts., alt. ca. 2500 ft., *Ferris* 7416 (DS NY, POM); Grapevine Canyon, n.e. entrance to Death Valley, 1.0-1.5 miles above Scotty's Castle, alt. ca. 3200 ft., *Straw* 899 (CAS, GH, MIN, NY, RM, UC, US); Titus Canyon, Grapevine Mts., n.e. side of Death Valley, alt. ca. 3000-4000 ft., *Straw* 900 (ARIZ, BM, CAS, COLO, F, GH, MIN, NY, UC, US, UTC); Trail Canyon, Panamint Range, s.w. side of Death Valley, Furnace Creek Quadrangle, alt. ca. 3000 ft., *Straw* 901 (MIN); Johnson Canyon, Panamint Range, Bennetts Well Quadrangle, alt. ca. 3000 ft., *Straw* 902 (GH, MIN, US); Townes Pass road, w. side of Panamint Range, Panamint Butte Quadrangle, alt. ca. 4100 ft., *Straw* 903 (CAS, GH, MIN, UC, US); Hopkins Ranch, Surprise Canyon, Panamint Mts., Telescope Peak Quadrangle, alt. 3000 ft., *Wolf & Johnson* 8763 (DS, RSA). Riverside Co.: Chuckwalla Mts., *Hall* 5970 (UC); south base, Pinto Mts., road Dale to Cottonwood Springs, alt. 2000 ft., *Munz* 15675 (DS, POM); Desert Center, *Nelson & Nelson* 3341 (DS, RM, SMU, UC); Hayfield, 37 miles e. of Indio, *Rose* 36828 (CAS); Mecca-Blythe road, ¾ mile w. of Utopia, alt. ca. 500 ft., *Wolf* 3038 (CAS, DS, RSA, UC, US). San Bernardino Co.: north side of Whipple Mts., alt. 950 ft., *Alexander & Kellogg* 1223 (GH, UC); Bagdad, *Brandegee s.n.* (UC); Copper Basin Creek, Whipple Mts., *Peirson* 11478 (RSA). San Diego Co.: Split Mt., Colorado Desert, *Brandegee s.n.* (UC).

NEVADA

Clark Co.: stony slopes, Las Vegas Mts., *Goodding* 2357 (GH, MO, RM).

11. ARGEMONE **subintegrifolia** G. B. Ownb., sp. nov.

A. platyceras var. *hispida* Johnston, in Proc. Calif. Acad. 12: 1025. 1924; not *A. platyceras* L. & O.; not *A. hispida* Gray.

Herba perennis. Caules sublignosi albi annui. Folia siccana coriacea glaucissima, foliis caulinis ellipticis non lobatis, in marginibus irregulariter dentata, superficibus regulariter aculeatis dispersis et rigidis aculeis. Alabastra oblonga. Sepalorum cornua brevia lataque 4-5 mm. longa. Flores 8-10 cm. diametro, 2-4 bracteis foliaribus subtensi, petalis albis. Capsulae 5-6-carpellatae, ovatae, dense spinescentes. Semina circa 1 mm. longa.

Stout perennial, the latex color unknown; stems 3-12 dm. tall, sparingly branched near the top, the branches annual, subligneous, white, armed throughout with rather close-set, long, rigid, perpendicular prickles; leaves coriaceous when dry, very glaucous, the basal ones unknown, the middle cauline to 10 cm. long, gradually reduced upward, elliptical, unlobed, the margin sometimes undulate, irregularly toothed, each tooth terminated by a prickle, the lower and upper surfaces evenly prickly with scattered,

long, rigid, erect prickles; buds broadly oblong, the body 15-17 mm. broad, 22-25 mm. long, abundantly prickly with slender, ascending prickles, the sepal horns short and broad, 4-5 mm. long including the terminal spine, prickly; flowers 8-10 cm. in diameter, closely subtended by 2-4 large foliar bracts; petals white, obovate to obcuneate; stamens numerous; stigma purple, about 3-4 mm. broad and 3 mm. high, sessile; capsules 5-6-carpellate, ovate, broadest near the base, the width, excluding the armature, 13-15 mm., the length, including the stigma, 25-30 mm., densely spinescent with small, ascending spines, the longest spines about 5-6 mm., the capsular surface barely visible through the armature; seeds just over 1 mm. long. (Ill.: Fig. 11, 1-2; Dist.: Fig. 13.)

Holotype: *C. Epling, M. Darsie, Wm. Steward & Wm. Robison s.n.*, from the western base of the Cocupah Mts., on the shores of Laguna Macuata, Feb. 19, 1933 (US; isotypes, DS, F, MO, NY, POM, RSA, UC).

Habitat and distribution: Rocky soils, northeastern Baja California and Angel de la Guarda Island, at elevations of near sea level.

Flowering and fruiting dates: First flowers appear by February 1; fruits are matured in March, April and May.

This species may be distinguished by its unlobed, dentate-margined, elliptical leaves, rigid, erect prickles on the leaf surfaces, white stems, short sepal horns, large flowers, large, sessile stigmas, rather densely spinescent capsules each with 5 or 6 carpels, and small seeds. It appears to be fully distinct from all other species of *Argemone*.

Dr. I. M. Johnston who first collected the species in 1921 noted upon his herbarium labels that it was probably new. I have, however, taken the specimens procured by Epling and his companions in 1933 as the type collection, since this collection is more widely distributed and shows the plants at an earlier and more representative stage of growth.

In his discussion of his collection, Johnson (1924) refers it to *A. platyceras* var. *hispida* (Gray) Prain with great reservation: "To this species is doubtfully to be referred a very peculiar collection made at the lagoon on Angel de la Guarda Island (3398). The specimens came from a small colony growing on an outcrop at the edge of an elevated mesa somewhat back from the shore. The plant had a woody caudex 3-6 dm. high upon which were borne the ascending simple stems of the year, these about 6 dm. long. Fruit, but no flowers, was found. The leaves are glaucous, aculeate, with shallow teeth, and are oblong in shape and narrowed towards the base. The shrubby character of the plant is very peculiar, but due to the lack of flowers, the plant is not named here." If I am correct in placing Johnston's collection in *A. subintegrifolia* the deficiency in flowering specimens is met. Johnston's observations are of the utmost value since he is the only botanist who are carefully observed the species in the field.

Specimens examined: MEXICO.

BAJA CALIFORNIA

Western base of Cocupah Mts. on shores of Laguna Maguata (i.e., Laguna Macuata

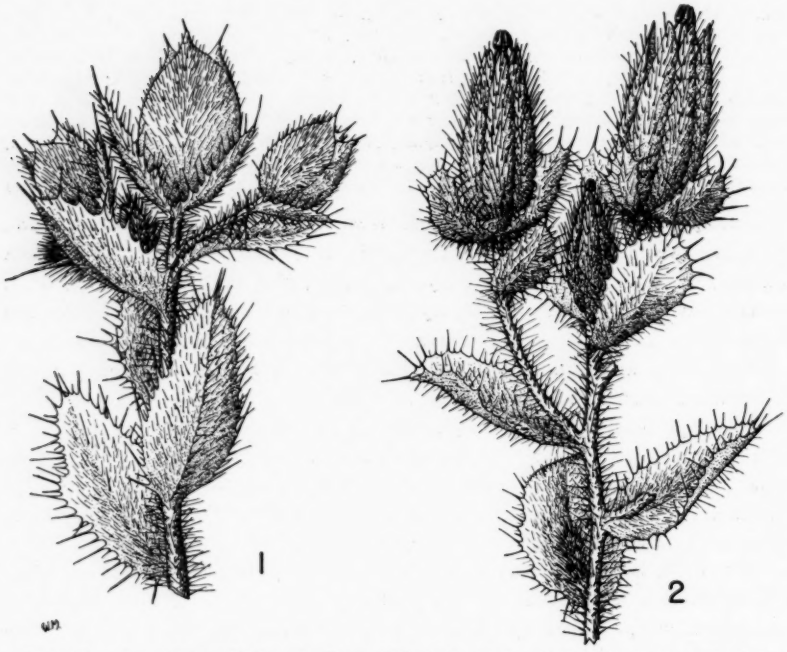

FIG. 11. *A. subintegrifolia*. 1. Stem with buds × 1. Holotype, *Epling et al. s.n.* (US). 2. Stem with capsules × 1. *Johnston* 3398 (CAS).

or Salada), *Epling et al. s.n.* (US, holotype of *A. subintegrifolia* Ownb.; isotypes, DS, F, MO, NY, POM, RSA, UC); The Lagoon, Angel de la Guarda Island, *Johnston* 3398 (CAS; GH, photograph; US, fragments and photograph).

12. ARGEMONE **brevicornuta** G. B. Ownb., sp. nov.

Herba perennis latice fulvo. Caules 3-5 dm. alti, dense aculeati. Alabastra subsphaerica, 12-14 mm. lata, 13-15 mm. longa, aculeis circa 2-3 mm. longis. Sepalorum cornua 3-5 mm. longa. Flores 7-9 cm. diametro, petalis albis, staminibus 150 vel plus, filamentis citro-flavis, antheris luteis. Capsulae 3-4-carpellatae, anguste elliptico-lanceolatae, 8-10 mm. latae, 25-35 mm. longae, spinibus sparsis magnitudine irregulari armatae. Semina circa 2 mm. longa.

Perennial with bright yellow latex; stems 1-several, 3-5 dm. tall, sparingly branched from the middle upward, rather copiously prickly with slender, perpendicular prickles; lower leaves often lobed to four-fifths of the distance to the midrib, the upper ones more shallowly lobed, the larger lobes oblong, the leaf margins with acute, prickle-tipped teeth, the leaf surfaces sparsely to copiously prickly below, prickly only on the main veins above; buds subspherical, 12-14 mm. broad, 13-15 mm. long, distinctly short prickly, these mostly 2-3 mm. long, the sepal horns comparatively short, 3-5 mm. in length, the weak, indurated apical spine sometimes visibly flattened; flowers 7-9 cm. in diameter, closely subtended by 1-2 foliar bracts; petals white, obovate-obcuneate; stamens about 150 or more, the filaments lemon yellow, the anthers yellow; stigma purple, 2.5-3.5 mm. wide, 1.5-2.5 mm. high; capsules 3-4-carpellate, narrowly elliptic-

lanceolate, the width, exclusive of armature, 8-10 mm., the length, including the stigma 25-35 (-40) mm., the surface armed with scattered, larger spines interspersed with smaller spines and prickles, the largest spines to 5-6 mm. long, the capsular surface clearly visible through the armature; seeds about 2 mm. long. (Ill.: Fig. 12, 1-4; Dist.: Fig. 13.)

Holotype: *Gerald B. Ownbey & Findley Ownbey* 1462, collected on rocky hillsides, dry soil, 23 miles n.w. of Meoqui on road to Chihuahua, Chihuahua, Mexico, July 29, 1950 (MIN; isotype, MIN).

Habitat and distribution: Gravelly soil, hills and intermountain plains, chaparral province, southern Chihuahua, Mexico, at altitudes of about 4000 to 5000 feet.

Flowering and fruiting dates: Limited data indicate that this species flowers from June to October or later and fruits from July to November.

This species is distinguished by its stem armature which generally consists of an abundance of long and slender perpendicular prickles, by its

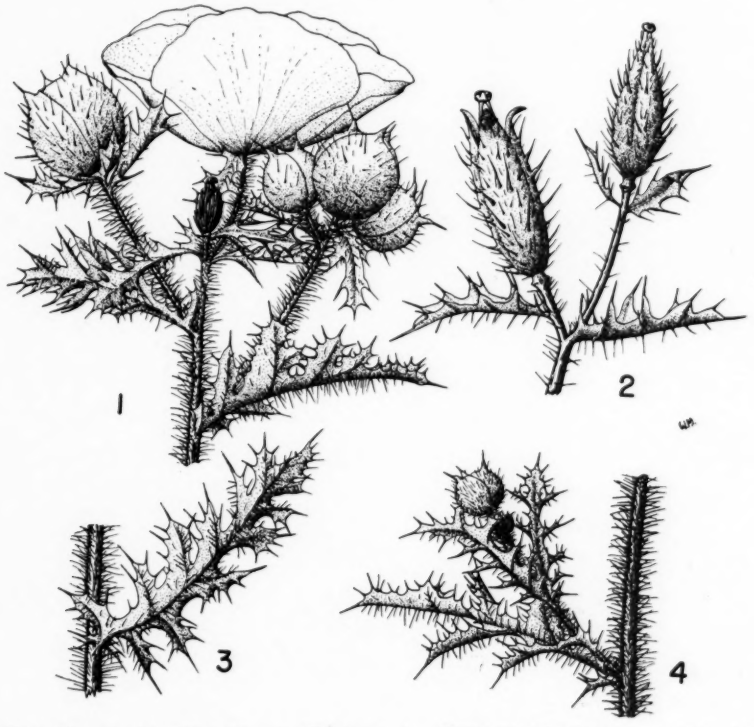

FIG. 12. *A. brevicornuta.* 1. Habit × 1. Holotype, *Ownbey & Ownbey* 1462 (MIN). 2. Capsules × 1. *Ownbey & Ownbey* 1845 (MIN). 3. Cauline leaf × 1. Same as 1. 4. Young branch × 1. Same as 1.

buds which are subspherical and distinctly short-prickly, and by its very short sepal horns. The buds are unlike those found in any other species of *Argemone*.

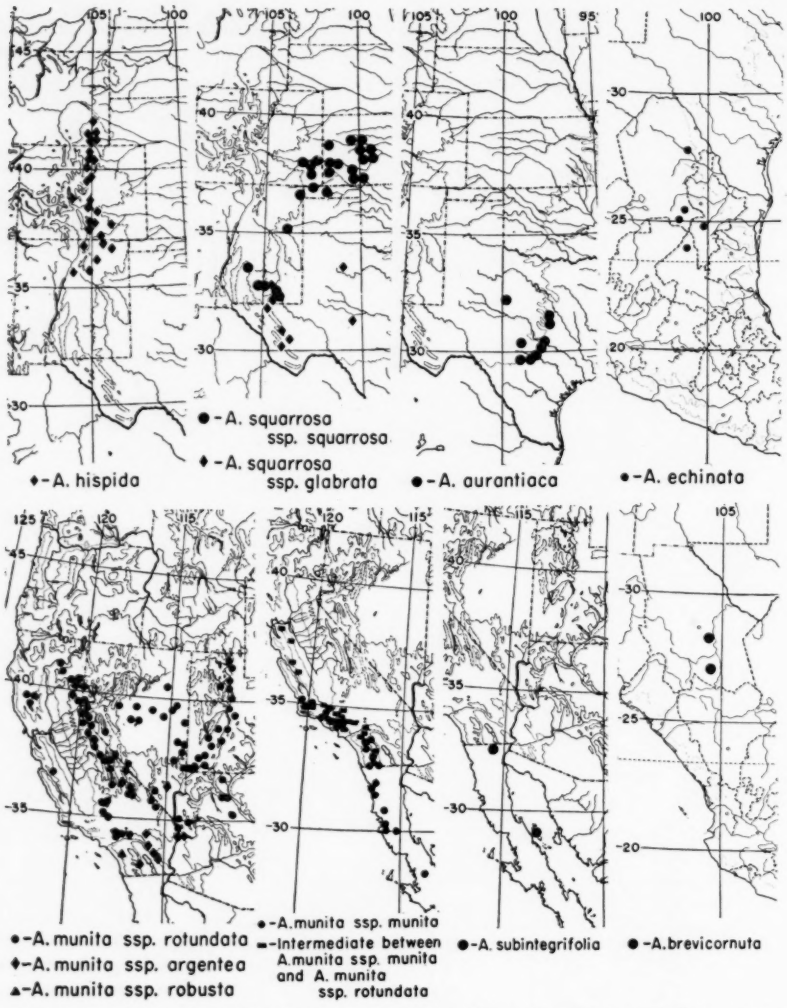

FIG. 13. Geographical distributions of species, subspecies and intermediates as indicated.

Specimens examined: MEXICO

CHIHUAHUA

Twenty-three miles n.w. of Meoqui, *Ownbey & Ownbey* 1462 (MIN, holotype of *A. brevicornuta* Ownb.; isotype, MIN); 17.3 miles n.w. of Meoqui, *Ownbey & Ownbey* 1845 (CAS, K, MICH, MIN, POM); 13.2 miles n.w. of Meoqui, *Ownbey & Ownbey* 1846 (ARIZ, F, GH, MEXU, MIN, MO, NY, UC, US); 19.6 miles e. of Hidalgo del Parral. *Ownbey & Ownbey* 1848 (MIN).

13. ARGEMONE **arizonica** G. B. Ownb., sp. nov.

A. platyceras Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; not *A. platyceras* L. & O.

Herba perennis latice pallide citreo, paene albido. Caules solitarii vel plures, 5-8 (-10) dm. alti, saepe decumbentes, diffuse ramosi omnino robuste et densius irregulariter aculeati, prope apices juvenales densissime aculeati. Folia profunde lobata fere usque ad costam, sinibus rectangularibus, lobis angustis saepe 5 vel plus longioribus quam latioribus, aliquando lobis brevibus secundariis, dentibus deltoideis, sparse aculeata subter in venis et supra in costa. Alabastra oblongo-elliptica, 12-15 mm. lata, 15-18 mm. longa, aculeata. Sepalorum cornua 12-15 mm. longa, tenua, aculeata. Flores 7-10 cm. diametro, petalis albis obovato-cuneatis, staminibus 100 vel plus, stigmate purpureo. Capsulae 3-carpellatae anguste elliptico-oblongae, 10-14 mm. latae spinis excludentibus, 35-45 mm. longae stylo tenui et stigmate includentibus, spinis tenuibus irregulari magnitudine 8-10 mm. longis armatae. Semina circa 2 mm. longa.

Perennial with pale lemon-yellow, almost white latex; stems 1-several, mostly 5-8 (-10) dm. tall, often decumbent, diffusely branched, closely prickly on the older parts with long, slender, uneven-sized, straight, perpendicular prickles, very densely prickly near the growing tips; basal and lower cauline leaves to about 20 cm. long, reduced upward, oblanceolate below to elliptic-lanceolate above, the blades deeply and distantly lobed to near the midrib, the sinuses rectangular, the lobes narrow, often five or more times as long as broad, sometimes with short secondary lobes, the primary and secondary lobes marginally toothed with deltoid teeth, each of which is terminated by a slender prickle, the under surfaces very sparingly prickly with long, rigid, straight prickles on the veins, the upper surfaces nearly smooth except for a few prickles on the midrib; buds elliptic-oblong, the body 12-15 mm. broad, 15-18 mm. long, armed with long, uneven-sized, simple prickles, the sepal horns extremely slender, terete, 12-15 mm. long including the long terminal spine, prickly on the basal one-half; flowers 7-10 cm. in diameter; petals white, obovate-obcuneate; stamens numerous, 100 or more, the filaments pale yellow, the anthers yellow; stigma purple, about 2-3 mm. broad, 2.0-2.5 mm. high, 3-lobed; capsules 3-carpellate, narrowly elliptic-oblong, the width, not including the armature, 10-14 mm., the length, including the slender style and stigma, 35-45 mm., closely beset with simple, slender, uneven-sized, straight spines, the largest of which may be 8-10 mm. long, the capsular surface clearly visible through the armature; seeds about 2 mm. long. (Ill.: Fig. 14, 1-4; Dist.: Fig. 18.)

Holotype: *Alice Eastwood & John T. Howell* 1003, from Grand Canyon National Park, "Kaibab trail to Roaring Springs," Arizona, June 23, 1933 (CAS; isotype, POM).

Habitat and distribution: Precipitous slopes of north wall of Grand Canyon along the Kaibab Trail, at elevations of possibly 3000-5000 ft., on unstable substratum; known only from the type locality.

Flowering and fruiting dates: Flowering begins in early June and may continue into October; fruits ripen from August until late autumn.

FIG. 14. *A. arizonica*. 1. Habit × ½. Holotype, *Eastwood & Howell* 1003 (CAS). 2. Leaf × ½. Topotype, *Ownbey & Ownbey* 1817 (MIN). 3. Capsule × 1. Liquid preserved material of topotype, *Ownbey & Ownbey* 1817 (MIN). 4. Bud × 1. Same as 3.

The distinguishing characteristics of this species are its deeply pinnatifid, remotely lobed leaves, its long and slender, uneven-sized prickles, its unusually long and slender sepal horns, its very pale lemon-yellow latex and its diffusely branching stem. Its affinities are uncertain, but possibly it is most closely related to *A. pleiacantha* subsp. *pleiacantha*. Two specimens seen by Fedde (US) were annotated and cited as *A. platyceras* L. & O., but this species as delimited in Fedde's monograph of the genus is composed of many irreconcilable elements.

First collected by F. H. Knowlton in 1889, *A. arizonica* has gone unrecognized until now. Due to the inaccessibility of much of the Grand Canyon its distribution within the canyon remains to be determined, but it is certainly comparatively localized.

Specimens examined: UNITED STATES.

ARIZONA

Grand Canyon National Park: Kaibab Trail to Roaring Springs, *Eastwood & Howell* 1003 (CAS, holotype of *A. arizonica* Ownb.; isotype, POM); Bright Angel Trail, Grand Canyon of the Colorado River, *Eastwood* 3679 (CAS); Kaibab Trail to Roaring Springs, *Eastwood & Howell* 7070 (CAS); Bright Angel Trail, alt. 4800 ft., *Goldman* 2221 (US); in the Grand Canyon of the Colorado, *Knowlton* 271 (US); Grand Canyon, alt. 2000-3000 ft., *McDougal* 240 (US); Kaibab Trail, about 3 miles from north terminus, *Ownbey & Ownbey* 1817 (ARIZ, CAS, COLO, F, GH, K, MIN, MO, NEW MEX, NY, POM, RM, SMU, TEX, UC, US).

14. ARGEMONE PLEIACANTHA Greene, in Fedde's Rep. Spec. Nov. 6: 161. 1908.

Annual or perennial with bright yellow or very pale lemon latex; stems 1-12 (-18) from the base, 5-12 dm. tall, mostly 10-20 mm. in diameter at the base, cymosely branched in the upper half, often purplish, sparingly to rather closely prickly throughout with ordinarily stoutish, rather even-sized, perpendicular prickles; leaves oblanceolate below, becoming elliptic-lanceolate upward, the upper ones sometimes clasping the stem, shallowly lobed to very deeply pinnatifid, the lamina surfaces sparingly armed principally on the veins beneath, smooth or more weakly prickly principally on the midrib above; buds subspherical or more often oblong-obovate, the body 11-18 (-22) mm. in diameter, 14-20 (-26) mm. long, sparsely to moderately prickly with simple or in part compound prickles, the sepal horns adaxially flattened and abaxially convex, or nearly terete, 4-12 mm. long including the apical spine; flowers 8-12 (-16) cm. in diameter; petals white; stamens about 150, the filaments pale yellow to red, the anthers yellow; stigma purple, 3-5 mm. broad, 2.5-4 mm. high, 3-4-lobed; capsules 3-4-carpellate, ovate to elliptic-lanceolate when mature, the width 10-16 (-18) mm., the length including the stigma 25-45 (-50) mm., densely spinescent to very sparsely spinescent, the longest spines 4-6 (-8) mm. long, these rarely with small secondary prickles near the base; seeds 2.0-2.5 mm. long.

Holotype: *O. B. Metcalfe* 1076, in dry gravel, approximate altitude, 6600 ft., Kingston, Sierra Co., New Mexico, July 6, 1904 (US; isotypes, CAS, F, GH, MIN, MO, NY, POM, UC, US).

Key to the subspecies:

1. Leaves usually deeply lobed; largest prickles of the buds often with secondary prickles; capsules usually closely spinescent; latex bright yellow when fresh; s.w.

New Mexico, s.e. Arizona and adjacent Chihuahua and Sonora ..... 14a. *A. pleiacantha* subsp. *pleiacantha*

1. Leaves very deeply to shallowly lobed; prickles of the buds all simple; capsules sparsely spinescent; latex pale lemon or bright yellow when fresh.
   2. Leaves pinnatifid to near the midrib, the sinuses rectangular, not at all clasping the stem at the base, latex very pale lemon; Sacramento Mts., New Mexico ..... 14b. *A. pleiacantha* subsp. *pinnatisecta*
   2. Leaves more shallowly lobed, sometimes manifestly clasping the stem at the base; latex bright yellow; central Arizona ..... 14c. *A. pleiacantha* subsp. *ambigua*

14a. ARGEMONE PLEIACANTHA Greene subsp. PLEIACANTHA

A. pleiacantha Greene, in Fedde's Rep. Spec. Nov. 6: 161. 1908.

A. hispida Torrey, in Pac. R. Rep. 7 (3): 7. 1856; Hemsl., Biol. Cent. Am., Bot. 1: 27. 1879, as to Thurber's collection from Sonora; not *A. hispida* Gray.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" β Prain, l.c., p. 368, in part; not *A. platyceras* L. & O.

A. munita Rose, in Contr. U. S. Nat. Herb. 8: 27. 1903; not *A. munita* Dur. & Hilg.

A. platyceras Fedde, in Pflanzenr. 4 (104): 283. 1909, in large part; Fedde, l.c., p. 274, fig. 36M, N, O; Woot. & Standl., Fl. N. Mex., in Contr. U. S. Nat. Herb. 19: 261. 1915, in part, as to New Mexico distribution; Kearn. & Peeb., Fl. Pl. Ariz., p. 336. 1942; Kearn. & Peeb., Ariz. Fl., p. 324. 1951, as to Arizona distribution; not *A. platyceras* L. & O.

A. platyceras var. *horridissima* Fedde, in Pflanzenr. 4 (104): 284. 1909, nomen nudum; not *A. platyceras* L. & O.

A. platyceras var. *pleiacantha* Fedde, l.c., p. 285; not *A. platyceras* L. & O.

A. platyceras var. *stenoceras* Fedde, l.c., p. 285; not *A. platyceras* L. & O.

Annual or perennial with bright yellow latex, often persisting by basal offshoots; stems 1-several from the base, 5-12 dm. tall, sparingly branched in the upper half, armed with scattered prickles to rather closely prickly, the prickles perpendicular; leaves oblanceolate to elliptic-lanceolate in outline, the cauline not manifestly clasping the stem, mostly deeply lobed, the broad sinuses reaching one-half to four-fifths the distance to the midrib, the lobes oblong, with marginal, deltoid teeth, each of which is terminated by a weak prickle, otherwise the leaves armed with scattered prickles on the veins, especially on the midrib beneath, often nearly smooth above; buds more or less closely subtended by the foliar bracts, but not obscured by them, the body subspherical to oblong-obovate, 12-18 (-22) mm. in diameter, 14-20 (-24) mm. long, sparsely to moderately prickly, often some of the larger prickles with one or more secondary prickles from the base, the sepal horns often adaxially flattened and abaxially convex, 8-12 (4-) mm. long, the horns conspicuously prickly and terminated by a basally flattened spine; flowers 8-12 (-16) cm. in diameter when fully open; petals white; stamens 150 or more, the filaments pale yellow to red, the anthers yellow; stigma purple, 3-5 mm. broad, 2.5-4.0 mm. high, 3-4-lobed; capsules 3-4-carpellate, ovate to elliptical when mature, the width, not including the armature, 10-16 mm., the length, including the stigma 30-45 (24-) mm., more or less closely spinescent with straight or incurved spines, the largest usually less than 6 mm. long, these rarely with small secondary prickles near the base, the capsular armature usually not completely obscuring the surface; seeds about 2 mm. long. (Ill.: Fig. 15, 3-6; Dist.: Fig. 18.)

Holotype: That of the species.

Habitat and distribution: Dry, gravelly, often disturbed soil, roadways, abandoned fields, and drainages, foothills and adjacent high plains, southwestern New Mexico, southeastern Arizona and adjacent Mexico, at elevations of 2500-7500 ft.

Flowering and fruiting dates: First flowers are produced in southern Arizona about April 1; flowering continues throughout the summer and fall until early November; late flowers often occur on new axillary shoots from the bases of the early stems; fruits begin to mature about June 15 and continue to mature until November.

The distinguishing characteristics of *A. pleiacantha* subsp. *pleiacantha* are the often deeply pinnatifid leaves which are only sparsely prickly on the main veins, the moderately prickly buds, the larger prickles of which often bear secondary prickles from the base, and the capsules which usually are densely prickly with uneven-sized prickles. The subspecies is easily separated from *A. hispida* with which it is sometimes confused by the absence of the crisped indumentum characteristic of the latter species. Its distribution is also completely disjunct from *A. hispida*. *A. pleiacantha* subsp. *pleiacantha* has often been lumped with *A. platyceras*, in the broad sense. *A. platyceras*, as delimited here, is a very distinct species differing from *A. pleiacantha* in many ways such as in its radially flattened sepal horns, its often pale lemon petals, its lower stamen number and its lack of compound prickles on the buds. Geographically, the two species are widely separated.

A. platyceras var. *horridissima* Fedde (in herb.; US) represents the most stoutly armed extreme of *A. pleiacantha* subsp. *pleicantha*. Plants of this sort are occasionally collected in New Mexico and Arizona. There may be sufficient basis for allowing this extreme phase the status of forma but, for the present, I believe it best not to recognize it nomenclatorially.

A. platyceras var. *stenoceras* is known only from the type specimen. It appears to be the smoothest phase of *A. pleiacantha* subsp. *pleiacantha*. The leaves partially clasp the stem at the base and are less deeply pinnatifid than is typical of the subspecies. The prickles of the buds are scattered and all are simple. The capsules appear to be typical of the subspecies although they are immature on the type specimen. For the present, at least, I feel that this proposed variety should be placed in synonomy.

Collections of *A. pleiacantha* subsp. *pleiacantha* from northwestern Chihuahua and northeastern Sonora are noteworthy for their less densely armored capsules. Such variations may be of significance but no inferences are possible at present.

Specimens of *A. pleiacantha* ssp. *pleiacantha* were cited by Prain in his revision of *Argemone* as part of *A. platyceras* var. *typica* "state" β. They comprised one of the larger elements of this heterogeneous group. In Fedde's revision, numerous specimens of this taxon were cited under *A. platyceras* proper, e.g., *Mearns* 59, *Wilcox* 101, *Toumey s.n.*, *Rose* 1299, and *Nelson* 6346.

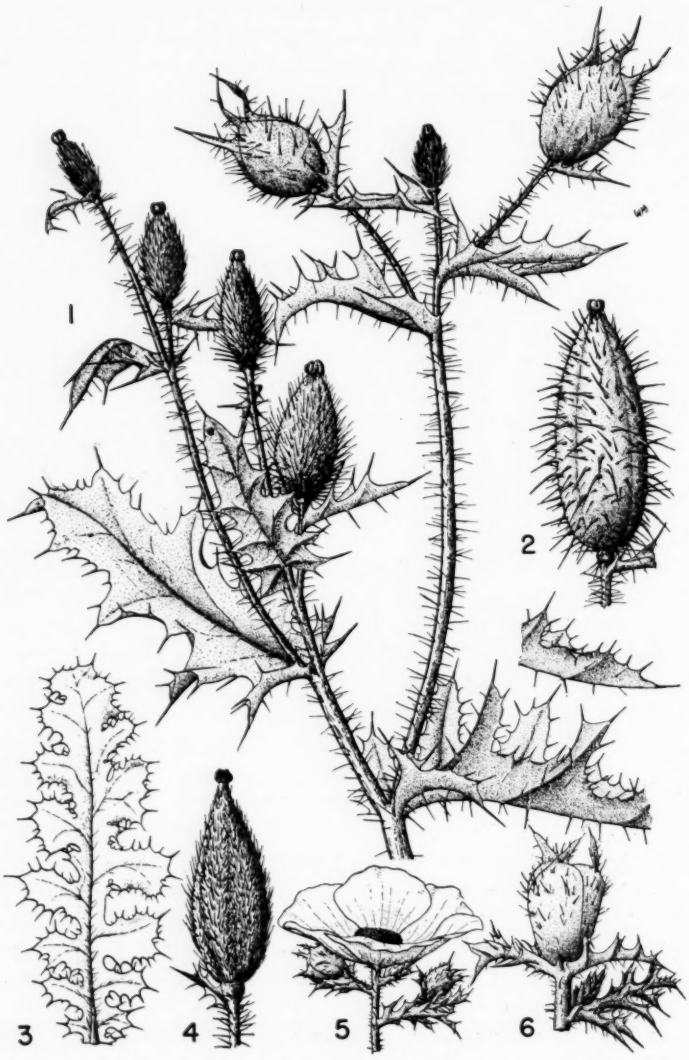

FIG. 15. 1-2. *A. pleiacantha* subsp. *ambigua*. 1. Habit × 1. Holotype, *Ownbey & Ownbey* 1827 (MIN). 2. Capsule × 1. Same as 1. 3-6. *A. pleiacantha* subsp. *pleiacantha*. 3. Upper surface of leaf × ½. Holotype, *Metcalfe* 1076 (US). 4. Capsule × 1. *Ownbey & Ownbey* 1474 (MIN). 5. Flower with buds × ½. Buds, *Ownbey & Ownbey* 1465; liquid preserved flowers of *Ownbey & Ownbey* 1757 (MIN). 6. Bud × 1. Liquid preserved material of *Ownbey & Ownbey* 1757 (MIN).

Putative natural hybrids between *A. pleiacantha* subsp. *pleiacantha* and *A. gracilenta* are sometimes found. The natural distribution of the former is in the foothills areas of southwestern New Mexico, southeastern Arizona and adjacent Chihuahua and Sonora. *A. gracilenta* is native to the flat valley floors and deserts of west-central Arizona southward in the Sonoran Desert for several hundred miles. The two species are fairly well separated ecologically and probably do not occur sympatrically except by introduction of *A. pleiacantha* into the irrigated valleys of the region especially along roadways and field borders. The existence of either species in these peripheral areas may be quite ephemeral and suitable conditions for direct interaction may not occur except at widely spaced and irregular intervals in time.

It is very difficult to assess the genetic effects of bringing these two species into proximity. Numerous examples of variation of a sort which would be attributed to hybridization could be enumerated. In the vicinity of Tucson, Arizona, both species and much aberrant material have been collected; much of the aberrant material is herein cited under *A. pleiacantha* subsp. *pleiacantha*. Some of these specimens have larger buds, larger capsules and larger leaves than is typical of the subspecies as found to the eastward. Some of them show characteristics of *A. gracilenta*, for example, *Toumey s.n.* (NY) has leaf margins and texture much as in *A. gracilenta; Thornber* 326 (US) has leaf margins, texture, capsule and bud enations intermediate between the two species; *Ownbey & Ownbey* 2095, collected near Cotaro, Ariz., is possibly a little closer in over-all aspect to *A. gracilenta* than to *A. pleiacantha*. At Magdalena, Sonora, some specimens, e.g., *Rose, Standley & Russell* 15115 (NY, US) exhibit the type of gigantism seen in the Tucson plants; *Rose, Standley & Russell* 15114 (US) is highly aberrant in leaf cuttings and enations of the capsules and buds.

Natural hybridization between *A. pleiacantha* subsp. *pleiacantha* and *A. ochroleuca* subsp. *ochroleuca* evidently is to be expected if the two occur together, a situation rarely met with in nature. *A. ochroleuca* occurs only as an introduced weed within the natural area of *A. pleiacantha*. Natural hybrids, probably all of the first generation, have been collected by my wife and myself at several localities in Sonora. The putative hybrids seen invariably occurred as isolated individuals, sometimes in the vicinity of one or both parents. No evidence of back-crossing was detected. The morphological appearance of the hybrids was normal in every respect and a large quantity of seeds was matured in each capsule.

Putative hybrids between *A. ochroleuca* and *A. pleiacantha* are large, vigorous plants with one or more stems from the base. The stems are often over a meter tall and the plants are conspicuous because of their large lemon-yellow flowers. In foliage characters they are distinctly intermediate

between the parents; likewise, the capsule armature is intermediate, consisting of intermixed coarse and fine spines of intermediate density. The stamen number is about 125, a number consistent with the expected result of crossing a species with a high stamen number with one having a low stamen number. Hybrid plants collected are as follows: *Ownbey & Ownbey* 1777c, from 27.9 miles s.w. of Moctezuma (GH, MIN); *Ownbey & Ownbey* 2078, from 3.6 miles n. of Imuris, Nogales-Magdalena road (MIN); *Ownbey & Ownbey* 2088, from 3.1 miles n.e. of Santa Ana on road to Magdalena (ARIZ, GH, MIN, US).

Specimens examined: UNITED STATES.

ARIZONA

Apache Co.: 3.1 miles n.w. of Eagar (Hwy. 73), *Ownbey & Ownbey* 1811 (ARIZ, BRY, COLO, F, ILL, MIN, NY, OKL, RSA, TEX, UC). Cochise Co.: Stephens' Ranch (Chiricahua Mts.), alt. 5700 ft., *Stephens s.n.* (*Blumer* 1814) (DS, GH, KSC, MIN, MO, NY, RM, US); Ft. Huachuca, *Wilcox* 101 (US). Navajo Co.: 11.4 miles s.w. of Show Low, *Ownbey & Ownbey* 1804 (ARIZ, BM, CAS, GH, MICH, MIN, NEW MEX, POM, RM, SMU, UTC, US); Taylor, *Zuck s.n.* (MO, NY, US). Pima Co.: Valley of the Rillito (Creek), *Pringle* 13616 (MO, PH, US); Tucson, *Toumey s.n.* (GH, NY, UC, US). Santa Cruz Co.: valley of Santa Cruz River, w. of Patagonia Mts., *Mearns & McVay* 1163 (NY); Calabasas, *Rose* 11945 (F, US); e. of Nogales, *Tidestrom* 765 (US). Yavapai Co.: 2.8 miles s.w. of Ashfork, *Ownbey & Ownbey* 1825 (ARIZ, CAS, GH, K, MICH, MIN, POM, UTC).

NEW MEXICO

Catron Co.: Beaverhead, alt. 2100 m., *Eggleston* 20450 (MO); Mogollon Mts., *Saunders s.n.* (CAS). Grant Co.: Dog Spring (s.e. corner of the Co.), *Mearns* 59 (US, type collection of *A. platyceras* var. *horridissima* Fedde; isotype, DS); Mangas Springs, 18 miles n.w. of Silver City, alt. 4770 ft., *Metcalfe* 646 (MIN, MO, ND, NY, RM, UC, US); 12.7 miles s.e. of Hurley, *Ownbey & Ownbey* 1467 (MIN); 2.4 miles e. of Separ, alt. 4500 ft., *Ownbey & Ownbey* 1757 (ARIZ, BRY, DAO, GH, MICH, MIN, NEW MEX, POM, SMU, UC); Silver City, *Snow s.n.* (CANU, MIN, MO, US); Cliff, *Wooton s.n.* (US). Hidalgo Co.: Cloverdale, *Mearns* 519 (US); 27 miles s. of Animas, alt. 5000 ft., *Wolf* 2572A (CAS, DS, GH, RSA). Luna Co.: 11.4 miles e. of outskirts of Deming, *Ownbey & Ownbey* 1465 (ARIZ, COLO, MIN, NEW MEX, NY, RM). Sierra Co.: Kingston, alt. 6600 ft., *Metcalfe* 1076 (US, holotype of *A. pleiacantha* Greene; isotypes, CAS, F, GH, MIN, MO, NY, POM, UC, US); 2.2 miles w. of Kingston, *Ownbey & Ownbey* 1474 (BM, CAS, GH, K, MIN, UC, US); Chiz (near Winston), *Wooton* 2906 (NEW MEX, UC, US).

MEXICO.

CHIHUAHUA

Sierra Madre w. of Pearson, *Barlow s.n.* (F); Casas Grandes, *Goldman* 416 (GH, US); St. (i.e., San) Diego, alt. 6000 ft., *Hartman* 673 (GH, US); between Colonia García and Pratt's Ranch below Pacheco, alt. 6000-7500 ft., *Nelson* 6273 (US, type collection of *A. platyceras* var. *stenoceras* Fedde); between Casas Grandes and Sabinal, alt. 5000-5500 ft., *Nelson* 6346 (US); 47.2 miles s.w. of Casas Grandes on road to García, *Ownbey & Ownbey* 2028 (GH, MIN, US); 16.2 miles s.w. of Casas Grandes on road to García, *Ownbey & Ownbey* 2031 (ARIZ, MICH, MIN, NY, RM, UC); 11.7

miles s.w. of Casas Grandes on road to García, *Ownbey & Ownbey* 2032 (BM, CAS, COLO, MIN); 10.1 miles s.w. of Casas Grandes on road to García, *Ownbey & Ownbey* 2033 (F, GH, K, MEXU, MICH, MIN, MO, POM); Carretas (Gran Morelos), border of Chihuahua and Sonora, alt. 4800 ft., *White* 2496 (GH, US).

SONORA

El Alamo, w. Magdalena, *Kennedy* 7064 (UC, US); 7.2 miles n. of Esqueda, *Ownbey & Ownbey* 1767 (ARIZ, GH, MICH, MIN, NY, RSA, UC, US); 0.7 mile n. of Esqueda, *Ownbey & Ownbey* 1768 (BM, CAS, COLO, F, MEXU, MIN, NEW MEX, POM, RM, TEX, WIS, WS); 27.9 miles s.w. of Moctezuma, *Ownbey & Ownbey* 1777b (ARIZ, GH, MIN, UC, US); 15.2 miles s. of Nogales, *Ownbey & Ownbey* 2077 (ARIZ, CAS, MEXU, MIN, NY, RM, RSA, UC, US); between Nogales and Guaymas, *Rose* 1299 (US); Magdalena, *Rose, Standley & Russell* 15114 (NY, US); Magdalena, *Rose, Standley & Russell* 15115 (NY, US); Colonia Oaxaca, *White* 420 (GH); Horocintos, Río Huachinera, region of the Río de Bavispe, *White* 2977 (GH, MEXU); 6 miles e. of Agua Prieta, alt. 3900 ft., *White* 3832 (GH); San José Mts., 2 miles s. of Naco, alt. 5000 ft., *Wolf* 2536 (CAS, DS, RSA).

14b. ARGEMONE PLEIACANTHA Greene subsp. **pinnatisecta** G. B. Ownb., subsp. nov.

A. platyceras Woot. & Standl., Fl. N. Mex., in Contr. U. S. Nat. Herb. 19: 261. 1915, in part, at to New Mexico distribution; not *A. platyceras* L. & O.

Herba annua aut perennis latice pallide citreo. Caules plerumque 3-12, 6-10 dm. alti, omnino robuste et regulariter aculeati. Folia usque ad et prope costam pinnatifida lobis distantibus, sinibus rectangularibus. Alabastra aculeis simplicibus. Sepalorum cornua subteretia. Capsulae 3-4-carpellatae, ellipticae vel late lanceolatae, aliquantum regulariter sed sparse spinescentes. Semina circa 2.5 mm. longa.

Annual or perennial with pale lemon, almost white latex; stems usually 3-12 from the base, 6-10 dm. tall, mostly 15-20 mm. in diameter at the base and retaining their diameter well upward, often purplish, cymosely branched in the upper half, stoutly and evenly prickly throughout, the prickles perpendicular; leaves oblanceolate, the lower cauline ones about 15 cm. long, progressively somewhat reduced in size upward, not clasping the stem, pinnatifid to near the midrib, the lobes distant, concave, with angular secondary lobes which are spine-tipped, the sinuses rectangular, the lamina surfaces sparingly and stoutly prickly on the under surfaces and veins, smooth above except for the midrib which has a few prickles; buds obovate, the body 12-14 mm. in diameter, 16-18 mm. long, moderately prickly, the simple prickles perpendicular, the sepal horns almost terete, 5-8 mm. long including the indurated apical spine; flowers 8.0-9.5 cm. in diameter; petals white, the outer margins undulate, the inner petals deltoid, the outer margin rounded, broadest just below the apex, about as broad as long, the outer suborbicular, broadest nearly one-half of the distance to the base; stamens about 150, with pale yellow filaments and yellow anthers, the inner filaments as long as the ovary at anthesis; stigma purple, about 3 mm. broad and high, 3-4-lobed; capsules 3-4-carpellate, elliptical, or slightly broader below the middle, when mature the width, not including the armature, 10-14 mm., the length, including the stigma, 25-40 mm., rather evenly but sparsely spinescent, the longest spines 4-5 mm. long, the capsular surface clearly visible; seeds about 2.5 mm. long. (Ill.: Fig. 16, 1-3; Dist.: Fig. 18.)

Holotype: *G. B. Ownbey & Findley* Ownbey 1754, from 9.6 miles west of Cloudcroft, altitude 6600 ft., Otero Co., New Mexico, Aug. 12, 1953 (MIN; isotypes, ARIZ, BM, CAS, COLO, F, GH, MIN, NEW MEX, RM, RSA, UC, US).

Habitat and distribution: Gravelly hillsides and disturbed embank-

ments, evidently limestone soils, west slope of Sacramento Mts., New Mexico, at altitudes of about 6400-7200 feet, towards the upper limits of the pinon-juniper zone.

FIG. 16. *A. pleiacantha* subsp. *pinnatisecta*. 1. Habit × ½. Holotype, *Ownbey & Ownbey* 1754 (MIN). 2. Capsule × 1. Liquid preserved material of *Ownbey & Ownbey* 1753 (MIN). 3. Buds × 1. Same as 2.

Flowering and fruiting dates: Flowering begins about May 1 and continues through the summer; fruits mature from midsummer until autumn.

This subspecies differs from subsp. *pleiacantha* in its more sparingly prickly capsules, in its exclusively simple bud prickles, and in its very pale lemon yellow latex. The sinuses of the leaves are deeper and broader and the lobes correspondingly narrower and longer than is usual in other subspecies of *A. pleiacantha*. Distributionally, it is much restricted; no other *Argemone* has been recorded from its natural area.

Specimens examined: UNITED STATES.

NEW MEXICO

Otero Co.: Sacramento Mts., *Earle* 585 (NY); 6.4 miles w. of Clouderoft, alt. about 7000 ft., *Ownbey & Ownbey* 1753 (BRY, ILL, K, MICH, MIN, MO, NY); 9.6 miles w. of Clouderoft, alt. 6600 ft., *Ownbey & Ownbey* 1754 (MIN, holotype of *A. pleiacantha* subsp. *pinnatisecta* Ownb.; isotypes, ARIZ, BM, CAS, COLO, F, GH, MIN, NEW MEX, RM, RSA, UC, UC); Rio Fresnal, Sacramento Mts., *Wooton s.n.* (US); La Luz Canyon, Sacramento Mts., *Wooton s.n.* (US).

14c. ARGEMONE PLEIACANTHA Greene subsp. **ambigua** G. B. Ownb., subsp. nov.

A. intermedia Kearn. & Peeb., Fl. Pl. Ariz., p. 336. 1942, in part; Kearn. & Peeb., Ariz. Fl., p. 324. 1951, in part, as to Arizona distribution; not *A. intermedia* Sweet.

Herba annua aut perennis latice flavo. Caules 1-8 (-18), 5-10 dm. alti, omnino distanter et sparse aculeati, aculeis subaequalibus. Folia leviter vel profundius lobata, superioribus saepe caulem amplectentibus. Alabastra subinermia vel moderate aculeata aculeis simplicibus. Sepalorum cornua plerumque ad axillas complanata, aliquando subteretia. Capsulae 3-4-carpellatae, plerumque elliptico-lanceolatae vel ovatae, aliquantum robuste et moderate vel levitissime et sparse spinescentes. Semina 2.0-2.5 mm. longa.

Annual or perennial with bright yellow latex; stems 1-8 (-18) from the base, about 5-10 dm. tall, mostly 10-16 mm. in diameter at the base, often purplish, cymosely branched from near the middle, distantly and sparingly prickly throughout with rather even-sized stoutish prickles on the main stem and weaker ones on the lateral, the prickles perpendicular; leaves to about 20 cm. long, reduced upward, oblanceolate below, lance-elliptic above, the upper cauline ones often clasping the stem, shallowly to rather deeply lobed, the lobes with angular secondary lobes which are prickly at the margins, sparingly and stoutly prickly on the veins beneath, sparingly prickly principally on the midrib above; buds obovate, the body 11-14 (-20) mm. in diameter, 14-18 (-26) mm. long, nearly smooth to moderately prickly with simple prickles, these perpendicular, the sepal horns sparingly prickly, usually flattened on the adaxial surface, sometimes nearly terete, 5-10 mm. long, including the apical spine; flowers 9-12 cm. in diameter; petals white, the inner deltoid, the outer deltoid-obovate; stamens about 150, with pale yellow filaments and yellow anthers, the filaments equalling or exceeding the ovary in length at anthesis; stigma purple, about 3-4 mm. broad and 2.5-3.0 mm. high, 3-4-lobed; capsules 3-4-carpellate, mostly elliptic-lanceolate or ovate, broader below the middle, when mature the width, not including the armature, 10-14 (-18) mm., the length, including the stigma, 26-36 (-50) mm., rather stoutly and moderately to very weakly and sparsely spinescent, the longest spines usually 4-6 (-8) mm. long, the capsular surface clearly visible; seeds 1.5-2.0 mm. broad, 2.0-2.5 mm. long. (Ill.: Fig. 15, 1-2; Dist.: Fig. 18.)

Holotype: *G. B. Ownbey & Findley Ownbey* 1827, from 10.3 miles n.e. of Prescott (Hwy. 89), Yavapai Co., Arizona, Sept. 10, 1953 (MIN; isotypes, ARIZ, CAS, COLO, F, GH, K, MICH, MIN, NEW MEX, NY, RM, RSA, UC, US).

Habitat and distribution: Slopes and meadows, roadways and embankments, well drained and usually gravelly soils, at altitudes of 3500-6000 ft., foothills of central Arizona.

Flowering and fruiting dates: Flowering begins about May 15 and continues until autumn; fruits begin to mature about July 1 and continue to ripen until November. Early flowering plants often flower again in the fall on lateral shoots, if moisture conditions permit.

This subspecies differs from subsp. *pleiacantha* in the very moderately to sparsely prickly capsules. The populations in the Ashfork and Prescott areas might almost be recognized as a separate subspecies. Plants from these areas have very large, elongate buds; the leaf sinuses often reach no more than one-half the distance to the midrib; the cauline leaf blades are comparatively broad at the base and more or less definitely clasp the stem. The need for further study of these populations is indicated. This subspecies together with *A. gracilenta* is probably the basis for the inclusion of *A. intermedia* (i.e. *A. polyanthemos*) in the Arizona Flora, by Kearney & Peebles. *A. polyanthemos,* according to my understanding of the species, does not occur within the state.

Evidence of hybridization between *A. pleiacantha* subsp. *ambigua* and *A. gracilenta* is found in some populations in west-central Arizona where their distributional areas impinge upon each other. Plants of putative hybrid origin combine the foliar and bud features of the parents. Those which vary in the direction of one or the other parent have been largely classified with the appropriate parent and cited thereunder. Putative hybrids of these two taxa are as follows: *Ownbey & Ownbey* 2166 from 4.1 miles n.e. of Valentine P. O., Mohave Co., alt. ca. 4000 ft. (ARIZ, CAS, GH, MIN, RM, RSA, UC, UTC, US); *Ownbey & Ownbey* 1826b, from 3.9 miles s. of Ashfork, Yavapai Co. (ARIZ, COLO, GH, MIN, RSA, UC, US).

Specimens examined: UNITED STATES.

ARIZONA

Coconino Co.: 0.8 mile e. of Flagstaff, *Ownbey & Ownbey* 1812 (ARIZ, GH, MIN). Gila Co.: Collom Camp, Matzatzal Mts., alt. 1200 m., *Collom s.n.*, 32 (GH, MO, ND, US); on road to Packard from Roosevelt, *Eastwood* 17136 (CAS); about 40 miles n.e. of Globe, alt. 4600 ft., *Kearney & Peebles* 12062 (CAS, POM); 16.6 miles s.e. of Roosevelt (Hwy. 88), *Ownbey & Ownbey* 1797 (ARIZ, COLO, MIN, NEW MEX, POM, RM, UC, US); 2.7 miles s.w. of Miami, *Ownbey & Ownbey* 1798 (BM, BRY, CAS, GH, MIN, NY, RSA, SMU, UTC); 37.2 miles n.e. of Globe (0.3 mile n.e. of Seneca), *Ownbey & Ownbey* 1803 (ARIZ, CAS, DAO, GH, MIN, NEW MEX, NY, POM, UC,

US, WS). Pinal Co.: Devil's Canyon near Superior, *Harrison* 2098 (US). Yavapai Co.: 2.2. miles e. of Ashfork, *Ownbey & Ownbey* 1824 (ARIZ, BM, BRY, CAS, COLO, F, GH, MIN, OKL, RM, RSA, UC, UTC, US); 10.3 miles n.e. of Prescott (Hwy. 89), *Ownbey & Ownbey* 1827 (MIN, holotype of *A. pleiacantha* subsp. *ambigua* Ownb.; isotypes, ARIZ, CAS, COLO, F, GH, K, MICH, MIN, NEW MEX, NY, RM, RSA, UC, US); 14.0 miles s.w. of Clarkdale, *Ownbey & Ownbey* 1828 (ARIZ, BM, BRY, ILL, MICH, MIN, POM, SMU, UTC, WIS, WS); western outskirts of Prescott, *Ownbey & Ownbey* 1829 (CAS, COLO, MIN, NY, RM); n. of Humboldt, *Tidestrom* 12713 (US); 2.9 miles n. of Rock Springs, *Ownbey & Ownbey* 2100 (ARIZ, GH, MIN, NEW MEX, UC, US); 1.6 miles s.w. of Peeples Valley, *Ownbey & Ownbey* 2105 (MIN).

15. ARGEMONE PLATYCERAS Link & Otto, Ic. Pl. Rar. Hort. Berol., part 1: 85, t. 43. 1830 (1831?).

A. platyceras Otto & Dietr., in Allgem. Gartenzeit. 1: 300. 1833; Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, in part; Rose, in Contr. U. S. Nat. Herb. 8: 26. 1903; Fedde, in Pflanzenr. 4 (104): 283, largely, excluding p. 274, fig. 36M, N, O.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in part.

A. platyceras var. *typica* Prain "state" α Prain, l.c., p. 368.

A. mexicana var. *aculeatissima* Morie. ex Prain, l.c., p. 367, nomen nudum in synonomy; not *A. mexicana* L.

Annual or longer-lived, the latex color not known; stems 1-few, usually 3.0-7.5 dm. tall, sparingly branched near the top, weakly armed with scattered, straight, rather even-sized, perpendicular prickles; leaves bluish, the lower ones oblanceolate, the middle and upper ones elliptical to ovate, the uppermost often clasping the stem, lobed, the sinuses of the lower ones to two-thirds or more of the distance to the midrib, more shallowly lobed upward, the lobes oblong, marginally dentate, the teeth lanceolate to acute, each terminated by a weak prickle, the leaf surfaces sparingly prickly on the veins above and below with uniform prickles, to nearly smooth; buds oblong, the body 14-18 mm. broad, 18-24 mm. long, sparsely to moderately prickly, the sepal horns usually very distinctly flattened in a radial plane at least toward the tip when fresh, 6-9 mm. long, prickly to near the tip and terminated by a weak, indurated, flattened spine; flowers usually not closely subtended by the foliar bracts, 10-12 (-15) cm. broad when fully expanded; petals white or often faintly lemon-yellow when fresh, often obcuneate; stamens about 75, the filaments pale yellow to reddish-lavender, the anthers yellow to lavender; stigma 3-5 mm. broad, 2-3.5 mm. high, 4-5 lobed, the sterile tissue between the lobes usually visible; capsules 4-5-carpellate, broadly elliptical to elliptic-ovate, the body excluding the armature but including the stigma, 14-24 mm. broad, 25-45 mm. long, the surface more or less densely spinescent with simple, straight, slender spines, but less so on the sutures, the larger spines 6-8 mm. long, the armature sometimes nearly or completely obscuring the capsular surface; seeds about 2 mm. long. (Ill.: Fig. 17, 1-2; Dist.: Fig. 18.)

Type: It is uncertain if any of the original material was preserved. The illustration provided with the original description may be taken as the type. This is in accordance with the 1956 edition of the International Code of Botanical Nomenclature, Article 10. The type locality is "in Cofre de Perote Prope Hacienda de la Laguna," Vera Cruz, Mexico. See below for additional discussion.

Habitat and distribution: A very common weed, mostly in cultivated or abandoned fields, valley floors, precipitous slopes, often volcanic soils, highlands, Vera Cruz to southern Hidalgo, and the state of México; northwestern Michoacán; northern Oaxaca; at elevations of 6000 to 10,000 feet.

Flowering and fruiting dates; Not well defined. Flowers are produced throughout the year but probably most abundantly from April 15 onward through the summer months; ripe fruits are most abundant from about May 15 to November.

Rose, l.c., in discussing the origin of the original material of the species says: "The type of this species is said to grow 'in Cofre de Perote prope Hacienda de la Laguna.' Just what is meant by this statement is not clear. The 'Hacienda de la Laguna' is near Jalapa, Vera Cruz. A more accurate statement would probably be 'above Hacienda de la Laguna toward the Cofre de Perote.' Mr. Pringle and the writer collected on the mountains above Jalapa, and consequently near the type locality, a plant which seems to answer in all essential particulars to Link and Otto's figure."

The preferred name for the Cofre de Perote is now the Cerro Nauhcampatepetl according to the American Geographical Society 1:1,000,000 Map of Hispanic America, Sheet N.E-14, 1952. The straight line distance from Jalapa to the summit of the Cerro is about 15 miles. In terms of miles, then, the type locality as originally stated is not too incorrect, and Rose and Pringle were certainly near this locality when they collected in the mountains above Jalapa.

According to Prain (1895, p. 371), *A. platyceras* was introduced into European gardens in 1827. However, Link & Otto state that seeds were sent by Schiede and Deppe in 1829 and that plants flowered in Berlin in 1829 and 1830. The original description and illustration was drawn from these plants. I have seen no specimens of the original material of *A. platyceras* and have seen no reference to any in literature. It is doubtful if any was preserved, since Fedde would surely have cited specimens on deposit at Berlin at the time of his monograph.

The Gray Herbarium of Harvard University has most kindly reproduced the original diagnosis and illustrations of *A. platyceras* from their copy of the Icones for my use. The diagnosis is very lucid and the illustration highly accurate in all important details. There can be no question as to the identity of this species, even in the absence of preserved specimens of the original cultivated materials.

A. platyceras is most clearly differentiated by its weakly and sparingly armed leaves and stems, by its very characteristically flattened sepal horns, and by its usually densely prickly capsules. It is perhaps most closely allied to *A. pleiacantha* on grounds of comparative morphology. I do not believe this alliance to be close.

A. platyceras usually has been combined with other more or less related species native to northern Mexico and southwestern United States during the past sixty years. For example, *A. platyceras,* in the broad sense, as treated in Prain's monograph includes elements of true *A. platyceras* L.

& O., *A. hispida* Gray, *A. arida* Rose, *A. munita* Dur. & Hilg., *A. squarrosa* Greene, *A. pleiacantha* Greene, *A. sanguinea* Greene, *A. aurantiaca* Ownbey and *A. echinata* Ownbey. Only Prain's *A. platyceras* var. *typica* "state" α is true *A. platyceras* L. & O. His "state" β included elements of *A. arida, A. munita, A. pleiacantha, A. sanguinea* and *A. echinata;* his "state" γ is entirely *A. sanguinea;* his "state" δ is mostly *A. aurantiaca,* but in small part is *A. squarrosa. A. platyceras* var. *hispida* of Prain's monograph is largely *A. hispida* Gray but includes elements of *A. munita* subsp. *munita* and of *A. munita* subsp. *rotundata.* A. *platyceras* var. *chilensis* of the same author is a distinct species native to South America, *A. rosea* Hook.

In Fedde's treatment of *Argemone,* cited specimens of *A. platyceras* proper include specimens which are correctly placed here, e.g., *Kerber* 225a, *Pringle* 8967, 11369, *Rose & Hay* 5306, 5355, *Rose & Hough* 4288, 4730, etc. Fedde also cites numerous specimens under *A. platyceras* which belong to other species, viz., to *A. munita* subspp., *A. pleiacantha* subsp. *pleiacantha, A. squarrosa* subspp. *squarrosa* and *glabrata, A. sanguinea, A. polyanthemos, A. albiflora* subsp. *texana, A. aenea, A. arizonica* and *A. echinata,* and doubtless others. Several of these taxa are newly described in this paper, and Fedde was merely following the custom of his day in drawing the specific lines of *A. platyceras* sufficiently broad to include such a wide array of forms. In addition to *A. platyceras* proper, Fedde lists six varieties: Var. *gracilenta* is, I believe, a distinct species; var. *stenoceras* is, I believe, assignable to *A. pleiacantha* subsp. *pleiacantha;* var. *pleiacantha* is Greene's *A. pleiacantha* and is herein treated as *A. pleiacantha* subsp. *pleiacantha;* var. *hispida* is true *A. hispida* when from the Rocky Mts., is *A. munita* subspp. when from the Great Basin and adjoining areas, and is *A. echinata* as to *Pringle* 8294 from the Rio Grande Valley; var. *hispido-rosea* and var. *hunnemannii* are Chilean taxa not considered in this paper, but they certainly are not assignable to *A. platyceras* L. & O.

It is clear from the above summary that both Prain's and Fedde's treatments of *A. platyceras* included a multitude of forms under this binomial. It is now evident that this name should be applied in the original sense of Link & Otto, and that the anomalous elements included thereunder by Prain and Fedde should be assigned to other species.

Rose, whose understanding of Mexican argemones surpassed that of any of his contemporaries, definitely and correctly allowed *A. platyceras* L. & O. to stand in its original circumscription with the statement: "A. *platyceras* is certainly to be kept distinct from our United States and northern Mexican forms." The present writer, having studied this species

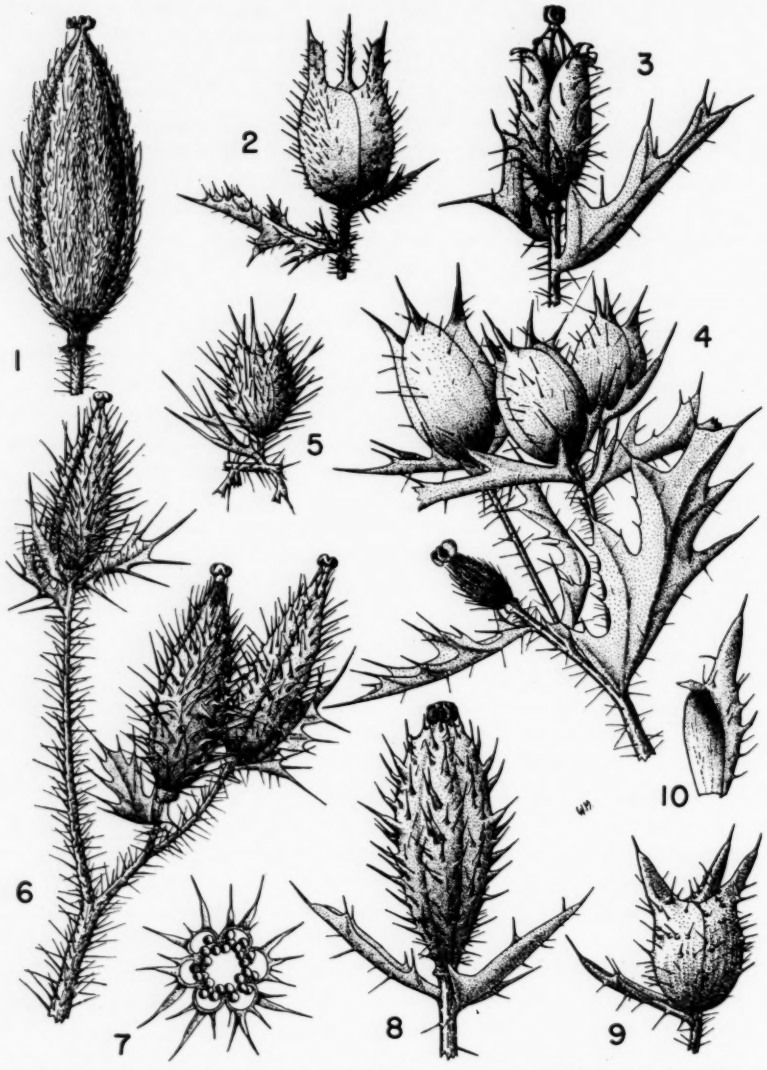

FIG. 17. 1-2. *A. platyceras*. 1. Capsule × 1. *Pringle* 11369 (US). 2. Bud × 1. *Balls* B4668 (UC). 3-4. *A. arida*. 3. Capsule × 1. *Ownbey & Ownbey* 1441 (MIN). 4. Habit × 1. Same as 3. 5-6. *A. chisosensis*. 5. Bud × 1. Isotype, *Ferris & Duncan* 3003 (CAS). 6. Capsules × 1. Holotype, *Ferris & Duncan* 3003 (NY). 7-10. *A. sanguinea*. 7. Capsule, x-section × 1. Liquid preserved material of *Ownbey & Ownbey* 1610 (MIN). 8. Capsule × 1. Same as 7. 9. Bud × 1. Same as 7. 10. Sepal × 1. Same as 7.

and all of the others mentioned above in the field, in the herbarium, and in large part under cultivation, concurs in this opinion.

Specimens examined: MEXICO.

FEDERAL DISTRICT

San Angel près Mexico, *Bourgeau* 7 (GH, UC, US); near Mixcoac, alt. 7500 ft., *Pringle* 8967 (CAS, F, GH, MEXU, MIN, MO, NY, UC, US); about Ajusco Station, alt. 9500 ft., *Pringle* 11369 (F, GH, MEXU, US).

MÉXICO

Real del Monte, *Herrera s.n.* (MEXU); Apam, *Millspaugh s.n.* (F); 9.7 miles n.w. of Colonia, *Ownbey & Ownbey* 1423 (F, GH, MIN, NY, US); between Pachuca & Real del Monte, *Rose, Painter & Rose* 8721 (GH, NY, US).

MÉXICO

Amecameca, alt. 8500 ft., *Balls* B4150 (UC); Ixtlahuaca, *Gregg* 720 (MO); Crucero Agua Blanca, *Hinton et al.* 6575 (F, GH, MEXU, NY, US); Amecameca, alt. 8600 ft., *Kuntze* 23651, *in part* (NY); 18.5 miles e. of Toluca, Hwy. 4, *Ownbey & Ownbey* 1429 (BM, CAS, F, GH, MEXU, MIN, NY, POM); 30.9 miles n.w. of Toluca (1.7 miles w. of Villa Victoria), *Ownbey & Ownbey* 2052 (COLO, K, MEXU, MIN, NY, RM, UC, US); near Ozumba, *Rose & Hay* 5355 (MEXU, US); near Toluca, alt. ca. 3000 m., *Schery* 81 (MO); S. Juan de Xico, Dist. de Chalco, ex herb. *Urbina s.n.* (MEXU).

MICHOACÁN

Cerro Tancítaro, Tancítaro, alt. 5000-9000 ft., *Leavenworth* 705 (F, GH); 17.0 miles w. of Zacapu, Hwy. 4, *Ownbey & Ownbey* 1432 (MIN); 1 mile e. of Carapán, *Ownbey & Ownbey* 1434 (GH, MICH, MIN, UC).

OAXACA

Valle de Nochixtlán, alt. 2180 m., *Conzatti* 4286 (MEXU, US); vicinity of Coixtlahuaca, alt. 7000-7500 ft., *Nelson* 1930 (US).

PUEBLA

Vicinity of Puebla, alt. 2150 m., *Arsène* 1299 (MO, US); Chalchicomula, *Smith* 113 (MIN, MO, US).

TLAXCALA

Santa Ana, alt. 2000 m., *Conzatti* 932 (GH).

VERA CRUZ

Above Los Molinos, Perote, alt. 9300 ft., *Balls* B4668 (UC); Orizaba, *Botteri* 261 (GH); Maltrata, *Kerber* 225a (CAS); Huatusco, *Mohr s.n.* (US); Las Vegas, *Rose & Hough* 4288 (US).

STATE UNKNOWN

Plantae Novae Hispaniae, *Sessé, Monciño, Castillo & Maldonado* 2261 (F).

16. ARGEMONE ARIDA Rose, in Contr. U. S. Nat. Herb. 8: 26. 1903.

A. platyceras var. *typica* Prain, in Journ. Bot. 33: 367. 1895, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" β Prain, l.c., p. 368, in small part; not *A. platyceras* L. & O.

A. intermedia Fedde, in Pflanzenr. 4 (104): 281. 1909, in small part; not *A. intermedia* Sweet.

Annual or short-lived perennial with yellow to orange latex; stems 1-few, 3-7 (-10) dm. tall, branched in the upper portions, very moderately to rather copiously prickly throughout with perpendicular or slightly recurved, slender prickles; leaves glaucous, the lower ones lobed one-half to three-fourths the distance to the midrib, the upper ones sometimes more shallowly lobed, the lobes oblong, often longitudinally folded, the marginal teeth acute, the lower surfaces of the leaves moderately prickly on the veins, the upper surfaces smooth or sparingly prickly on the main veins; buds oblong, the body 12-15 mm. broad, 16-20 (-24) mm. long, sparingly and evenly prickly with ascending prickles, the sepal horns slender, sometimes flattened, the length 7-10 (-12) mm., often with a few prickles near the base, terminated by a weak spine; flowers 7-10 (-12) cm. broad, more or less closely subtended by 1-2 foliar bracts; petals white or with a faint lemon-yellow tinge, obcuneate, the outer more broadly so; stamens 80-120 or more, the filaments pale lemon-yellow to red, the anthers yellow or tinged with purple, the stamens and ovary subequal at anthesis; stigma 3-5-lobed, purple, about 3-4 mm. wide and 1.5-2.5 mm. high; capsules 3-5-carpellate, elliptic-oblong to lanceolate, the width, exclusive of armature, 12-15 mm., the length, including the stigma 25-40 (-45) mm., thinly to rather closely armed with uneven-sized spines and prickles, the largest spines to about 8 mm. long, the capsular surface sometimes partially obscured; seeds about 1.8-2.2 mm. long. (Ill.: Fig. 17, 3-4; Dist.: Fig. 18.)

Holotype: *J. N. Rose & Walter Hough* 4864 collected "on the arid plains about San Luis Potosí," San Luis Potosí, Mexico, July 13, 1899 (US).

Habitat and distribution: High prairies and intermountain plains, gravelly or alluvial soil, often a weed around corn and bean fields or other cultivated or disturbed areas, southern Chihuahua to San Luis Potosí, Mexico, at elevations generally between 5800 and 6800 feet.

Flowering and fruiting dates: Flowering probably begins about June 1 and continues through the summer and autumn at least through October; fruits are matured from July to November and December.

Argemone arida is one of the least known species of the genus because of the near absence of specimens in herbaria. It is most easily recognized by its oblong buds, slender sepal horns, obcuneate white or very pale lemon-yellow petals, usually red filaments and usually rather densely and simply spinescent capsules. On the basis of field observations, I am convinced that this species is most closely related to *A. platyceras*. It differs most markedly from *A. platyceras* in its less densely spinescent capsules and in its slender sepal horns which are usually quite unlike those of the latter species.

In the original description of *A. arida*, Rose mentions the long styles of the new species as of importance. The mature capsules of the holotype do have styles 2-4 mm. long, but in all other specimens of *A. arida* seen by the writer the style is 1 mm. or less in length. The holotype, therefore, is aberrant in this character and possibly even abnormal. Generally speaking, style length in *Argemone* has proved to be of little or no diagnostic value.

The only species of *Argemone* which occurs in the same distributional

area as *A. arida* is *A. ochroleuca*. These two species often occur side by side but evidently do not cross in nature.

Specimens examined: MEXICO.

CHIHUAHUA

14.4 miles e. of Hidalgo del Parral, *Ownbey & Ownbey* 1458 (MIN).

DURANGO

Ramos to Indé, *Nelson* 4719 (GH, US); 1.6 miles s.e. of Nombre de Dios, *Ownbey & Ownbey* 1444 (MIN); 6.3 miles n.e. of Villa Madero, *Ownbey & Ownbey* 1447 (MIN, US, UC); 8.6 miles n.w. of La Zarca, *Ownbey & Ownbey* 1453 (CAS, MIN, MO, NY); 26.9 miles s.e. of La Zarca on road to Durango, *Ownbey & Ownbey* 2034 (COLO, F, K, MEXU, MICH, MIN, RM, RSA, UC).

SAN LUIS POTOSÍ

Border of Jalisco, 10.6 miles e. of Ojuelos de Jalisco, *Ownbey & Ownbey* 2039 (ARIZ, CAS, COLO, F, GH, K, MEXU, MICH, MIN, MO, NY, RM, RSA, SMU, TEX, UC, US); 0.1 mile s.w. of San Luis Potosí, *Ownbey & Ownbey* 2040 (GH, MEXU, MIN, NY, US); 3.4 miles n.e. of Soledad Díez Gutiérrez, *Ownbey & Ownbey* 2041 (CAS, F, MIN, POM, UC); San Luis Potosí, *Rose & Hough* 4864 (US, holotype of *A. arida* Rose).

ZACATECAS

19.7 miles n. of Rincón de Ramos, *Ownbey & Ownbey* 1438 (K, MEXU, MICH, MIN, UC, US); 19.5 miles s.e. of Fresnillo, *Ownbey & Ownbey* 1441 (GH, MIN, MO); 4.2 miles n.w. of Sain Alto road junction with main hwy., *Ownbey & Ownbey* 2008 (CAS, COLO, F, MIN, MO); 4.9 miles s.e. of Zacatecas, *Ownbey & Ownbey* 2009 (MIN, NY, RM, RSA, SMU); 41.3 miles e. of Sombrerete on road to Fresnillo, *Ownbey & Ownbey* 2036 (GH, K, MEXU, MICH, MIN, NY, UC, US); 5.6 miles s. of Ojocaliente, *Ownbey & Ownbey* 2037 (C, CAS, F, GA, GH, K, MEXU, MIN, NY, RM, SMU, TEX, UC, US).

17. ARGEMONE SANGUINEA Greene, in Pittonia 4: 68. 1899.

A. sanguinea Rose, in Contr. U. S. Nat. Herb. 8: 25. 1903.

A. platyceras Wats., in Proc. Am. Acad. 17: 318. 1882, as to *Palmer* 20; Hemsl., Biol. Cent. Am., Bot. 4: 4. 1886, as to *Palmer* 20; Coult., in Contr. U. S. Nat. Herb. 2: 12. 1891, in part, excluding *A. hispida* Gray, in synonymy; Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, in part; Small, Fl. s.e. U. S., p. 462. 1903, as to Texas distribution, in part; Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; not *A. platyceras* L. & O.

A. mexicana Britton & Rusby, in Trans. N. Y. Acad. Sci. 7:7. 1887; not *A. mexicana* L.

A. platyceras var. *rosea* Coulter, in Contr. U. S. Nat. Herb. 1: 30. 1890; Coult., l.c., 2: 12. 1891; Swift, in Addisonia 20: 49, t. 665. 1939; not *A. platyceras* L. & O.; not *A. rosea* Hook.

A. intermedia var. *typica* Prain, in Journ. Bot. 33: 363. 1895, in part; not *A. intermedia* Sweet.

A. platyceras var. *typica* Prain, l.c., p. 367, in small part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" β Prain, l.c., p. 368, in part; not *A. platyceras* L. & O.

A. platyceras var. *typica* Prain "state" γ Prain, l.c., p. 369; not *A. platyceras* L. & O.

A. mexicana var. *rosea* Coulter ex Greene, in Pittonia 4: 68. 1899, erroneous reference to *A. platyceras* var. *rosea* Coulter; not *A. mexicana* L.; not *A. rosea* Hook.

A. purpurea Rose ex Pringle, Pl. Mex., no. 8277. 1900, nomen nudum; Rose ex Fedde, in Pflanzenr. 4 (104): 280. 1909.

A. pinnatifida Norton, in Trans. Acad. Sci. St. Louis 12: 38. 1902.

A. delicatula Small (?), Fl. s.e. U. S., p. 462. 1903.

A. intermedia Fedde, in Pflanzenr. 4 (104): 281. 1909, in part; not *A. intermedia* Sweet.

A. pinnatifida f. *rosea* Cockerell, in Journ. N. Y. Entomol. Soc. 25: 192. 1917; not *A. rosea* Hook.

Annual, biennial or short-lived perennial with pale to bright yellow latex; stems 1-few, often 4-8 (-12) dm. tall, simple below, widely branched above, sparingly prickly with perpendicular to recurved prickles; leaves glaucous, the veins conspicuously light blue-lined, the lower cauline and basal deeply lobed to four-fifths the distance to the midrib, the middle and upper cauline often less deeply lobed, the lobes oblong and with marginal acute, prickle-tipped teeth, the lower surfaces moderately prickly on the main veins, the upper surfaces almost smooth to sparsely prickly on the main veins; buds broadly elliptic-oblong, the body 10-15 mm. broad, 12-20 mm. long, moderately prickly with spreading prickles, the sepal horns basally slightly prickly, often angular in cross-section, 5-10 mm. long including the indurated, sometimes slightly flattened apical spine; flowers 6-9 cm. in diameter, usually closely subtended by 1-2 small foliar bracts; petals white to lavender, broadly obovate-obcuneate to sub-orbicular, distally erose; stamens 150 or more, about equalling the ovary in length at anthesis, the filaments lemon yellow to red, the anthers yellow to lavender; stigma purple, not sinuate, about 2.5-5.0 mm. wide and 1.5-3.0 mm. high; capsules 3-5 (-6)-carpellate, narrowly to broadly elliptical, the width, exclusive of spines, 8-15 (-18) mm., the length, including the stigma, 25-40 (-50) mm., armed with stout, often recurved spines interspersed with smaller spines and prickles, the largest spines commonly 5-7 (-10) mm. long, the capsular surface clearly visible; seeds strongly apiculate at the micropyle, the longest dimension about 1.5 mm. excluding the micropylar beak. (Ill.: Fig. 17, 7-10; Dist.: Fig. 18.)

Holotype: *G. C. Nealley* 9, from Corpus Christi, Nueces Co., Texas, 1889 (F), i.e., the type of *A. platyceras* var. *rosea* Coulter. The number *9* is the serial number assigned to this taxon by Coulter in his publication, l.c.

Habitat and distribution: Roadways, field margins, embankments, vacant lots and generally disturbed areas; occasional in chaparral plains, sandy soils or evidently sometimes in limestone soils in the west; southern Texas and adjacent Mexico westward to Val Verde Co., but rare in western Texas; also in southern Coahuila; found at altitudes of near sea level in the east to 4000-5000 ft. in the west and south.

Flowering and fruiting dates: Most abundant flowering begins in late February and continues through March and April; fruits are ripened from late March through May, where conditions for growth are suitable in the essentially frost free parts of southern Texas and adjacent Mexico; however, flowers and fruits may be produced at any time during the year.

A. sanguinea is recognized by its deeply cut, conspicuously light blue-lined leaves, its large white to lavender flowers, its elliptic-oblong buds which are rather sparingly prickly with spreading prickles, its usually long sepal horns and its elliptical capsules which are armed with uneven-

sized spines. The species is magnificently illustrated by Sorensen in Swift's account of the species under the name *A. platyceras rosea.* The distribution of *A. sanguinea* impinges upon that of *A. albiflora* subsp. *texana* to the north and immature specimens of the two taxa are sometimes difficult to distinguish. Ways of separating the two are discussed under the latter taxon.

The oldest name proposed for this species is *A. platyceras* var. *rosea* Coulter. This taxon is, however, specifically distinct from *A. platyceras* L. & O. Since the varietal name could not be raised to species rank because of the older *A. rosea* Hook., Greene rightly proposed a new name, *A. sanguinea.* Although Greene erroneously cited the original name as "*A. Mexicana,* var. *rosea,* Coulter, Bot. West Texas, p. 12," there can be no question as to his real intent and the new name must stand.

A. sanguinea is identical to "state" γ of *A. platyceras* var. *typica* Prain and, in part, is "state" β of the same author. It is only one of many diverse elements included under the variety by this author, and in actuality is not at all closely related to *A. platyceras.* Specimens of *A. sanguinea* are also cited by Prain under *A. intermedia* var. *typica.* Specimens of *A. sanguinea,* viz., *Nealley* 22 and *Heller* 1378, are cited under *A. platyceras* proper by Fedde.

A. pinnatifida Norton must be rejected because of Greene's earlier binomial. It refers, without question, to the same entity as *A. sanguinea.*

A. purpurea Rose was originally published by Pringle as a nomen nudum in a list of plants which he had collected. The collection cited was *Pringle* 8277 from near Eagle Pass, Texas. Many duplicates of this number, bearing the label name *A. purpurea* Rose, were distributed to herbaria. It must be assumed that Rose had proposed this name provisionally but that he realized that the taxon was conspecific with *A. sanguinea* before publication. It is notable that, in Rose's paper on the argemones of Mexico, *Pringle* 8277 is cited under *A. sanguinea.* Without regard for its debatable standing, *A. purpurea* Rose was validly published by Fedde. *Pringle* 8277 is the only specimen cited. The confusion is further increased in Fedde's revision when *A. sanguinea* Greene is placed in synonymy under *A. platyceras* as was done by Prain.

A. delicatula Small is of uncertain identity since no specimens were cited in the original description. Likewise, no authentic specimens bearing this label name have been found in herbaria. The name was omitted entirely in Small's manual. It seems most likely, however, that this name is most properly relegated to synonymy under *A. sanguinea.*

The treatment of *A. sanguinea* presented here must be considered preliminary. Morphologically, a great deal of variation is included under

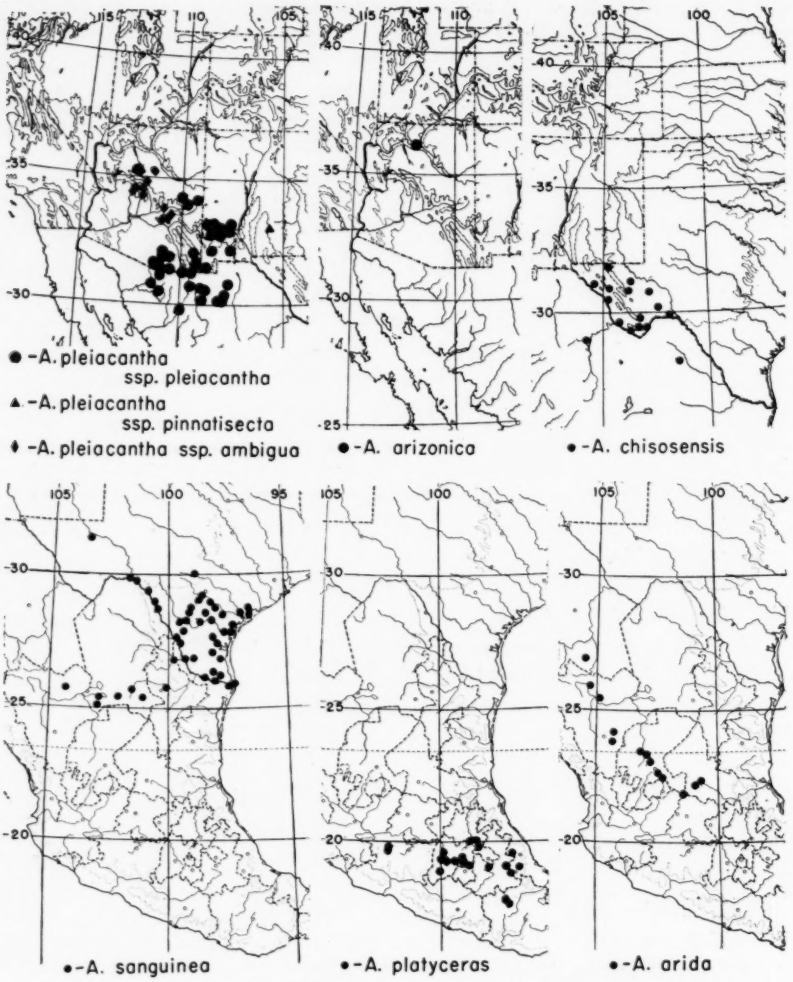

FIG. 18. Geographical distributions of species and subspecies as indicated.

this binomial. Whether or not several taxa are involved in producing this complex variation pattern probably cannot be demonstrated by descriptive methods although statistically significant differences between certain populations could probably be demonstrated. Extensive cytogenetic analysis of this and other Texas species is needed before any conclusions as to the biological nature of *A. sanguinea* can be drawn.

With regard to the Texas material, I am unable consistently to distinguish the diploid from the tetraploid phase of *A. sanguinea* on the basis of herbarium material. Many specimens have been collected only in early flower or in flower and very immature fruit and are of little value. Garden cultures of the two appear to be distinguishable as follows: The diploid phase has narrowly elliptical capsules which are more finely and densely prickly, very prickly buds and finely divided leaves; the tetraploid phase has broadly elliptical capsules which are less densely prickly, moderately prickly buds and more coarsely divided leaves. The diploid, on the basis of the limited data now available, appears to be absent from the eastern portion of the species range where the tetraploid is commonest.

Specimens examined: UNITED STATES.

TEXAS

Aransas Co.: near Rockport, *Whitehouse* 11807 (SMU). Atascosa Co.: 3 miles n. of Campbellton, *Whitehouse* 18396 (SMU). Bee Co.: 5.3 miles s.w. of Berclair, *Ownbey & Ownbey* 1604 (MIN). Bexar Co.: San Antonio, *Mackensen* 151 (F). Brooks Co.: Falfurrias, *Ownbey & Ownbey* 1613 (ARIZ, COLO, F, GA, GH, KSC, MICH, MIN, NY, SMU, TEX, UC, US, WIS, WS). Calhoun Co.: Port Lavaca, *Tharp* 1589 (TEX, US). Cameron Co.: 4.9 miles e. of Edcough, *Ownbey & Ownbey* 1617 (GH, MIN, UC, US). Dimmit Co.: Carrizo Springs, *Jones* 28235 (CAS, DS, MO, POM, RM, UC). Duval Co.: San Diego, *Croft* 98 (MIN, NY); San Diego, *Nealley* 22 (F, TEX, US). Frio Co.: Moore, *Eggert s.n.* (MO). Gillespie Co.: Crab Apple Cr., *Jermy* 218 (MO, US, duplicates of syntype of *A. pinnatifida* Norton). Goliad Co.: 3.9 miles n.e. of Goliad, *Ownbey & Ownbey* 1600 (MIN). Hidalgo Co.: 3.2 miles w. of Mission, *Ownbey & Ownbey* 1625 (BM, CAS, COLO, GH, ILL, MIN, NEW MEX, NY, UC). Jim Hogg Co.: between Guerra and Randado, *Tharp, Johnson & Webster* 48-28 (TEX). Jim Wells Co.: 1.9 miles n.e. of Alice, *Ownbey & Ownbey* 1609 (BM, CAS, F, MIN, NY, OKL, POM, RM, SMU). Karnes Co.: s. of Kenedy, *Whitehouse* 18116 (SMU, US). Kenedy Co.: 6 miles s. of Norias, *Shinners* 17818 (SMU). Kleburg Co.: King's Ranch, *Schulz* 61 (US). La Salle Co.: 10.2 miles n.w. of Cotulla, *Shinners* 17297 (MIN, SMU). Live Oak Co.: 41 miles n. of Alice, *Painter & Barkley* 14462 (TEX). Maverick Co.: 0.6 mile s.e. of Quemado, *Ownbey & Ownbey* 1631 (F, MIN, NY, SMU, TEX, UC); Rio Grande valley near Eagle Pass, alt. 700 ft., *Pringle* 8277 (US, holotype of *A. purpurea* Rose ex Fedde; isotypes, F, GH, MEXU, MIN, MO, ND, NY, PH, POM, RM, UC, US, *A. purpurea* Rose, in herbaria). McMullen Co.: 20 miles s.w. of Tilden, *Rogers, Albers & Webster* 6805 (TEX). Nueces Co.: Corpus Christi, alt. sea level to 40 ft., *Heller* 1378 (F, GH, MIN, MO, NY, RM, UC, US, duplicates of syntype of *A. pinnatifida* Norton); Corpus Christi, *Nealley* 9 (F, holotype of *A. platyceras* var. *rosea* Coulter, i.e., of *A. sanguinea* Greene). Pecos Co.: Mesquite valleys, *Tharp* 43-586, in part (CAS, TEX, UC). Reeves Co.: 1 mile e. of Saragosa, *Cory* 52146 (SMU, US). Refugio Co.: about 6 miles n. of Bayside, *Whitehouse* 21232 (SMU). San Patricio Co.: 6.5 miles s.e. of Sinton, *Ownbey & Ownbey* 1608 (K, KSC, MICH, MIN, SMU, TEX, UC, US). Starr Co.: 8 miles e. of Rio Grande City, *Clover* 192 (MEXU, TEX). Val Verde Co.: 14.9 miles w. of Langtry, *Ownbey & Ownbey* 1637 (MIN, TEX, US). Victoria Co.: 9.7 miles n.e. of Victoria, *Ownbey & Ownbey* 1590 (GA, GH, ILL, MIN, OKL, SMU). Webb Co.: 9 miles s.e. of Laredo, *Ownbey & Ownbey* 1629 (KSC, MIN, OKL, SMU, US). Wilson Co.: 12 miles w. of Floresville, *Cory* 55375 (SMU, US). Zapata Co.: 3.1 miles n.w. of Zapata, *Ownbey & Ownbey* 1628 (MIN, POM, RM, SMU, TEX, US).

MEXICO.

COAHUILA

S. Paila, alt. 1375 m., *Hinton, et al.* 16600 (GH, US); Parras, *Palmer* 20 (GH, NY, US); Parras, *Palmer* 442 (F, GH, MO, NY, UC, US); Saltillo, *Palmer* 564 (F, GH, MO, NY, UC, US); Matamoros, *Pringle* 9191 (US); 12 miles n. of Hipólito, road to Monclova, *White* 1695 (GH).

DURANGO

57.3 miles w. of Gómez Palacio on road through Mapimí, *Ownbey & Ownbey* 1451 (MIN); 17.3 miles s.w. of Ciudad Lerdo on road to Durango, *Ownbey & Ownbey* 1862 (BM, CAS, F, GH, MEXU, MICH, MIN, MO, NY, SMU, UC, US); 4.3 miles s.w. of Cuencamé on road to Durango, *Ownbey & Ownbey* 1864 (GH, MEXU, MIN, US).

NUEVO LEÓN

14.8 miles n. of Vallecillo, *Ownbey & Ownbey* 1402 (MIN); Monterrey, *Trelease* 10 (MO).

18. ARGEMONE **chisosensis** G. B. Ownb., sp. nov.

A. platyceras McDoug. & Sperry, Pl. Big Bend, p. 80. 1951; not *A. platyceras* L. & O.

Herba biennis aut perennis vetustiori aetate caudice robusto et carnoso. Caules 4-8 dm. alti, sparse vel dense aculeati. Alabastra plerumque conspicue aculeata, aculeis robustis perpendicularibus, petalis albis vel pallide purpureis. Capsulae anguste ellipticolanceolatae vel aliquando elliptico-ovatae, 8-13 mm. latae, 30-45 mm. longae. Semina circa 1.8-2.2 mm. longa.

Biennial or perennial with yellow latex, the older plants with a stout, fleshy caudex; stems 1-few, 4-8 dm. tall, sparingly branched, sparsely to copiously prickly with long, slender, perpendicular prickles; lower leaves lobed to near the midrib, the middle and upper ones usually less deeply lobed, the lobes distant, the larger ones oblong, the margins of the lobes with acute teeth, the lower leaf surfaces stoutly armed on the midvein and less so on the secondaries, the upper surfaces almost smooth or weakly armed on the main veins; buds broadly elliptical, the body 11-15 mm. wide, 15-20 mm. long, mostly moderately prickly with strong, perpendicular prickles, the sepal horns terete, or angular in cross-section, 8-10 (7-12) mm. long, the basal portion usually prickly with perpendicular prickles, the long, indurated apical spine sometimes flattened at its juncture with the herbaceous basal portion; flowers 7-10 cm. in diameter, usually closely subtended by 1-2 foliar bracts; petals white to pale lavender, suborbicular to obcuneate-obovate; stamens about 150 or more, the filaments pale lemon yellow or red, the anthers yellow or purplish; stigma purple, about 2.5-3.5 mm. wide, 1.5-2.5 mm. high; capsules 3-4-carpellate, mostly narrowly elliptic-lanceolate, sometimes elliptic-ovate, the width, excluding the armature, 8-13 mm., the length, including the stigma, 30-45 mm., armed with scattered, stout, spreading or slightly recurved spines interspersed with a few smaller spines and prickles, the largest spines to about 10 mm. long, the capsular surface clearly visible through the armature; seeds about 1.8-2.2 mm. long. (Ill.: Fig. 17, 5-6; Dist.: Fig. 18.)

Holotype: *Roxana S. Ferris & Carl D. Duncan* 3003, collected in Juniper Canyon, Chisos Mountains, Brewster Co., Texas, July 15-18, 1921 (NY; isotypes, CAS, DS, MO).

Habitat and distribution: Arid plains and mountains, often along drainages; evidently in a wide range of soil types; western Texas and adjacent Mexico, at elevations of about 3000-6500 ft.

Flowering and fruiting dates: First flowers usually open by March 15; flowering continues as local conditions permit until December. First fruits mature by April 15 and fruits continue to mature until December.

This taxon, in typical aspect, is set apart by its evidently perennial caudex, bristly stems and buds, long sepal horns and usually narrowly elliptic-lanceolate capsules. Plants collected at higher elevations in the Chisos Mountains area are very distinctive. Collections from peripheral areas, however, exhibit less marked prickliness and other anomalies. In some instances such plants are not easily separated from species occupying adjacent regions, especially *A. sanguinea*. *Palmer* 349, from Aldama, Chihuahua, is even more coarsely armed than the type material. It may be that some of these anomalous elements will ultimately be assigned to other taxa. For this reason I am according *A. chisosensis* specific rank with some hesitancy. More extensive field studies as well as experimental work are a necessary prerequisite to a fuller understanding of this taxon.

Specimens examined: UNITED STATES.

TEXAS

Brewster Co.: Oak Canyon, Chisos Mts., *Cory* 6994 (GH); Juniper Canyon, Chisos Mts., *Ferris & Duncan* 3003 (NY, holotype of *A. chisosensis* Ownb.; isotypes, CAS, DS, MO); 25 miles n. of Boquillas, *Hanson* 588 (NY, US); Chisos Mts., *Marsh* 107 (F); 25.6 miles s. of Marathon, *Ownbey & Ownbey* 1639 (MIN); Mt. Emory, *Schultz* 4241 (F); The Basin, Chisos Mts., *Sperry* 383 (US); e. of Nugent Mt., *Sperry* 1369 (US); Glenn Springs, Chisos Mts. area, *Warnock* 146 (TEX); s. of Alpine on Terlingua road, *Whitehouse* 703 (NY, SMU). Culberson Co.: 4.6 miles n.e. of Pine Springs, *Ownbey & Ownbey* 1740 (ARIZ, COLO, GH, MIN, NEW MEX, NY, SMU, TEX, UC, US); s. of Wylie Mts., about 13 miles s.e. of Van Horn, *Waterfall* 5113 (MO); n.e. side of Beach Mt., 7 miles n. of Van Horn, *Waterfall* 4659 (CAS, GH, MO, NY). Hudspeth Co.: Sierra Blanca, *Mulford* 282 (MO); 9 miles n.w. of Sierra Blanca, *Ownbey & Ownbey* 2053 (CAS, F, GH, MIN, MO, POM, RM, SMU); Carrizo Mts., 7 miles w. of Van Horn, *Waterfall* 5052 (GH); Indian Hot Springs, s. of Sierra Blanca, *Whitehouse* 8281 (F). Jeff Davis Co.: Madera Springs, *Whitehouse* 11816 (SMU). Pecos Co.: Ft. Stockton, *Whitehouse* 8280 (F, TEX); mesquite flats, *Tharp* 43-585 (RM, TEX); same loc., *Tharp* 43-586, *in part* (DS, GH). Presidio Co.: 4¾ miles n.e. of Porvenir, *Cory* 53574 (SMU); Alamito Creek on Rio Grande, *Hinckley* 1478 (NY); Van Creek about 2 miles s. of county line, alt. 1050 m., *Hinckley* 1622 (SMU, TEX); near Shafter, *Ingram* 2606 (US); n.e. side of Chinati Mts., *Muller* 8323 (SMU). Reeves Co.: 9¾ miles s. of Balmorhea, *Cory* 18404 (GH); 15.5 miles s.w. of Pecos, *Cory* 52128 (SMU); near Balmorhea, *Whitehouse* 11818 (SMU). Terrell Co.: Sanderson, *Orcutt* 670 (US); 20 miles e. of Dryden, *Parks, Turner & Warnock* 147 (TEX). Val Verde Co.: 5 miles w. of Langtry, alt. 1370 ft., *Warnock & Cameron* 9927 (SMU).

MEXICO.

CHIHUAHUA

Vicinity of Aldama, *Palmer* 249 (NY, US).

COAHUILA

Múzquiz, *Marsh* 1052 (F); El Berrendo, near Múzquiz, alt. 4000 ft., *White* 1845 (GH).

19. ARGEMONE CORYMBOSA Greene, in Bull. Calif. Acad. 2: 59. 1886.

Perennial with orange latex; stems cymosely branched, the ultimate branches short, sparsely to moderately armed with stout, perpendicular or recurved spines, densely foliate; leaves coriaceous, green or glaucous, shallowly to deeply lobed, the surfaces smooth to sparingly prickly especially on the midrib beneath; buds subspherical to elliptic-obovate, the body 6-14 mm. broad, 10-18 mm. long, the sepal horns 5-7 mm. long; flowers 4-9 cm. in diameter; petals white; stamens about 100-120, the filaments pale yellow, the anthers yellow; stigma yellowish-green to purple, 3-4 mm. broad, 2.5-3.0 mm. high; capsules ovate to lanceolate, 3-5-carpellate, the width, exclusive of armature, 10-16 mm., the length, including the stigma, 25-35 mm., the surface stoutly and rather evenly, but not closely armed with spreading spines, the largest of which is about 5-7 mm. long; seeds about 1.5-2.0 mm. long.

Holotype: *Mrs. M. K. Curran s.n.* (i.e., Mrs. Katherine Brandegee), Mojave Desert, California, June, 1884 (GH; isotype, UC).[1]

Key to the subspecies:

1. All the leaves shallowly lobed to essentially unlobed; Mojave Desert of California ..... 19a. *A. corymbosa subsp. corymbosa*
1. Lower leaves deeply lobed, the middle and upper ones more shallowly lobed; s.e. Utah and n.e. Arizona ..... 19b. *A. corymbosa* subsp. *arenicola*

19a. ARGEMONE CORYMBOSA Greene subsp. CORYMBOSA

A. corymbosa Greene, in Bull. Calif. Acad. 2: 59. 1886; Gray, Syn. Fl. N. Am. 1 (1): 88. 1895; Wolf, in Rancho Santa Ana Bot. Gard. Occ. Papers, ser. 1 (2): 59. 1938; Abrams, Ill. Fl. 2: 230. 1944.

A. intermedia var. *typica* Prain, in Journ. Bot. 33: 363. 1895, in small part; not *A. intermedia* Sweet.

A. intermedia var. *corymbosa* Eastwood, in Erythea 4: 96. 1896; Fedde, in Pflanzenr. 4 (104): 282. 1909; Parish, in Bot. Gaz. 65: 337. 1918; Jeps., Fl. Calif. 1: 560. 1922, fig. 116 excluded; Jeps., Man. Fl. Pl. Calif., p. 400. 1925; Munz, Man. S. Calif. Bot., p. 182. 1935; not *A. intermedia* Sweet.

Stems 1-4, 5-8 dm. tall, much branched in the upper parts; leaves green or faintly glaucous beneath, glaucous above, the basal and lower cauline 8-12 (-20) cm. long, obovate to oblanceolate, shallowly lobed, the apices of the lobes rounded, the middle and upper cauline leaves progressively smaller and successively obovate, elliptical and ovate, more shallowly to very shallowly if at all lobed, the margins of all the leaves sparingly prickly with stout prickles, the broad bases of the upper cauline leaves clasping the stem, the leaf surfaces sparingly but stoutly prickly on the main veins beneath, smooth or very sparingly and more weakly prickly on the midrib and main veins above; buds subspherical to elliptic-obovate, the body 10-14 mm. broad, 12-16 mm. long, sparingly prickly with spreading prickles; flowers 5-9 cm. in diameter; stigmas evidently purple, about 3.0 mm. broad and 2.5 mm. high; capsules 4-5-carpellate, ovate to lanceolate, the width, excluding the armature, 10-15 mm., the length, including the stigma, 25-30 mm., stoutly and rather evenly but not closely spinescent, the largest spines usually 6-7 mm. long; seeds bluish-black, usually just over 1.5 mm. long. (Ill.: Fig. 19, 1-3; Dist.: Fig. 25.)

Holotype: That of the species.

Habitat and distribution: Dry, open flats, slopes, stabilized dunes and

[1] Wolf (1938) expresses the opinion that Kelso is the type locality of this species. This may be true since Mrs. Brandegee is known to have collected it there in 1917. However, she had also collected the species at Nipton in 1915, and this or elsewhere on the Mojave might actually be the type locality.

washes, sandy or granitic soils, Mohave Desert, San Bernardino Co., Calif., at altitudes of about 1400-3000 ft.

Flowering and fruiting dates: Flowering begins in late March or early April; fruits mature from about May 15 through June.

A. corymbosa subsp. *corymbosa* is distinguished by its sparingly, coarsely prickly, stout, cymosely much branched stems, the short and numerous ultimate branches of which lend a congested appearance to the inflorescence, and by the dense foliage, the leaves being coriaceous, shallowly lobed or subentire and the broad bases of the upper ones often clasping. The ovate-lanceolate, rather evenly and stoutly spinescent capsules are also very characteristic.

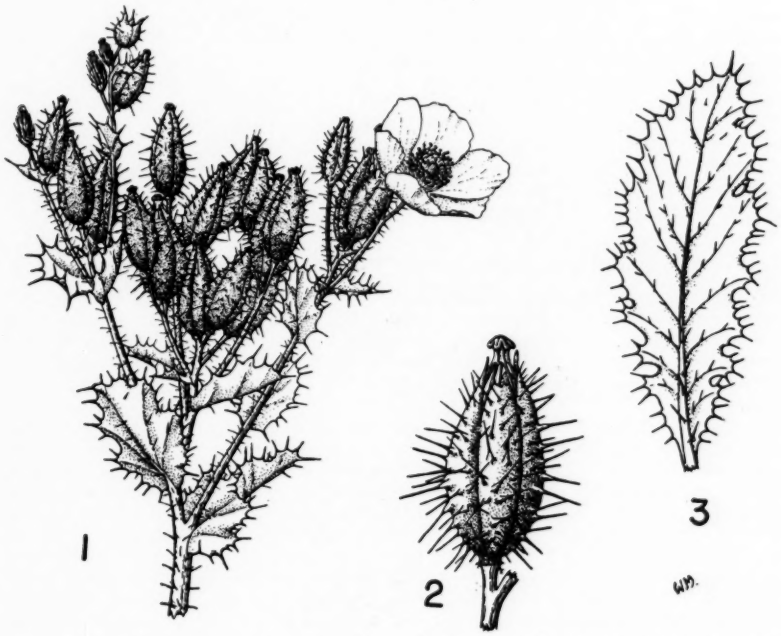

FIG. 19. *A. corymbosa* subsp. *corymbosa*. 1. Habit × ½. *Ownbey & Ownbey* 2130 (MIN). 2. Capsule × 1. *Wolf & Johnson* 8766 (US). 3. Cauline leaf × ½. Same as 1.

This, the originally described component of the species, has been little known except by western botanists. Prain through lack of knowledge and specimens included the species in synonymy under his collective taxon *A. intermedia* var. *typica*. It has been accorded full species rank by Ameri-

can taxonomists with the exception of Miss Eastwood who unjustifiably reduced it to varietal status under *A. intermedia* (auct., non Sweet, i.e., *A. polyanthemos*). Fedde followed Eastwood in making it a variety of *A. intermedia*. Wolf, who was well acquainted with the taxon in the field, correctly allowed it the status of full species.

Specimens examined: UNITED STATES.

CALIFORNIA

Kern Co.: ca. 8 miles n. of Johannesburg, *Gifford s.n.* (DAV). San Bernardino Co.: Granitic slopes on s. side of Cronise Valley, U. S. Hwy. 91, *Abrams* 14011 (DS, GH); Nipton, *Brandegee s.n.* (UC); Kelso, *Brandegee s.n.* (CAS, DS, GH, POM, UC, US); along Mojave River, *Cooper s.n.* (US); Mohave Desert, *Curran s.n.* (GH, holotype of *A. corymbosa* Greene; isotype, capsules only, UC); Black's ranch, s.e. of Fremont's Peak, *Hall & Chandler* 6848 (UC); Mojave Desert, *Morse s.n.* (NY); eastern Mojave Desert, 3 miles w. of Nipton, alt. 3000 ft., *Munz* 11699 (DS, RSA); 2.4 miles s. of Kelso, alt. about 2200 ft., *Ownbey & Ownbey* 2130 (ARIZ, CAS, COLO, F, GH, K, MIN, MO, NY, RM, UC, US); Silver Lake, *Parish* 10372 (DS); 6 miles e. of Lucerne Valley, Mojave Desert, alt. 3000 ft., *Roos & Roos* 4304 (RSA); Mojave Desert, 1 mile e. of Pisgah, *Wolf* 8544 (CAS, DS, POM, RSA, UC); same locality, *Wolf & Johnson* 8766 (CAS, DS, RSA, UC, US); 7 miles s. of Kelso on Amboy road, alt. about 2500 ft., *Wolf* 10190 (RSA, UC); 10 miles s.e. of Baker on road to Kelso, alt. about 1400 ft., *Wolf* 10274 (RSA, UC); Cronise Valley on U. S. Hwy. 91 between Baker and Yermo, alt. ca. 1000 ft., *Wolf* 10328 (DS, RSA); 8 miles n. of Valley Wells on road to Kingston, alt. ca. 3300 ft., *Wolf* 1033 (RSA).

19b. ARGEMONE CORYMBOSA Greene subsp. **arenicola** G. B. Ownb., subsp. nov.

Herba perennis latice aurantiaco. Caules 1-5 (-15), 2-6 dm. alti. Folia crassa coriaceaque, lobata, sinibus usque ½-⅘ spatium ad costam extendentibus, superficie subter ad costam aculeis paucis, supra inermia aut 1-4 aculeis tenuibus. Stigma flavoviride aut purpurans. Capsulae lanceo-ovatae, 3-5-carpellatae. Semina circa 2.0 mm. longa.

Stems 1-5 (-15), 2-6 dm. tall, moderately branched, green, rarely tinged with pink; leaves glaucous or green below, green or slightly glaucous above, the basal ones 8-15 cm. long, oblanceolate, lobed, the sinuses extending from one-half to four-fifths the distance to the midrib, the lobes oblong, the middle and upper cauline ones elliptical to lanceovate, more shallowly lobed, the uppermost tending to half-clasp the stem, the margins of all the leaves with deltoid teeth, the leaf surfaces with a few stout prickles on the main veins beneath, smooth or with 1-4 fine prickles above; buds obovate to elliptical, the body 6-12 mm. broad, 10-18 mm. long, simetimes tinged with pink, the surface moderately armed with distant, divergent, perpendicular prickles, the sepal horns sometimes flattened in a tangential plane; flowers 4-8 cm. in diameter; outer petals as broad as long, suborbicular, erose on the distal margin, the inner ones broadly suborbicular-obcuneate, much broader than long, similarly erose distally; stamens surpassed by the ovary; stigmas yellowish-green or purplish, sinuate, about 4 mm. broad and 3 mm. high; capsules 3-4 (-5) -carpellate, lance-ovate, the width, excluding the armature, 14-16 mm., the length, including the stigma, 25-35 mm., stoutly armed with even-sized, large, spreading spines, the largest of which are usually 5-6 mm. long; seeds bluish-black, about 2.0 mm. long. (Ill.: Fig. 20, 1-5; Dist.: Fig. 25.)

Holotype: *G. B. Ownbey and Findley Ownbey* 2146, collected 37.9 miles southwest of Green River, on the road to Hanksville, in rust-colored sand

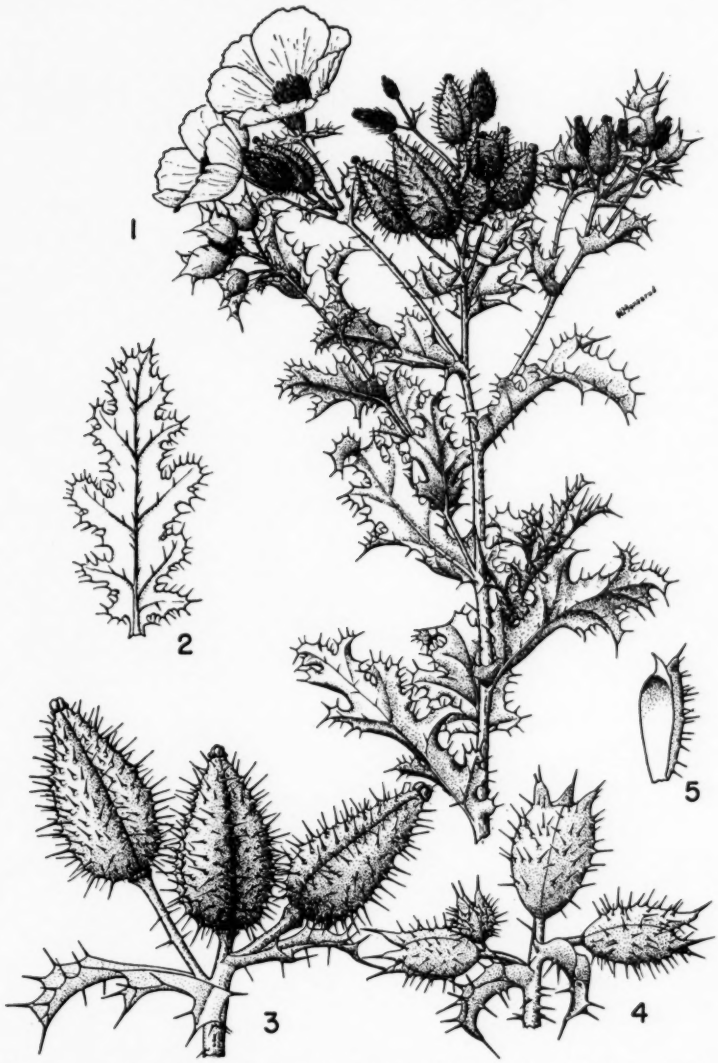

FIG. 20. *A. corymbosa* subsp. *arenicola*. 1. Habit × ½. Holotype, *Ownbey & Ownbey* 2146 (MIN). 2. Cauline leaf × ½. Same as 1. 3. Capsules × 1. Liquid preserved material from type collection; same as 1 (MIN). 4. Buds × 1. Same as 3. 5. Sepal × 1. Same as 3.

dune areas, Emery Co., Utah, June 7, 1954 (MIN; isotypes, ARIZ, BRY, CAS, COLO, DAO, F, GH, K, MEXU, MICH, MIN, MO, NEW MEX, NY, OKL, POM, RM, RSA, SMU, TEX, UC, UTC, US, WS).

Habitat and distribution: Dry desert valleys and plains, especially in areas of stabilized sand or actively moving sand dunes, southeastern Utah and northeastern Arizona, at altitudes of 3000-5000 ft.

Flowering and fruiting dates: Flowering begins about May 1; fruits begin to mature about June 1; under favorable conditions a second flowering and fruiting period may occur during the summer and autumn months.

In the past, specimens of this subspecies have been variously identified as *A. intermedia, A. hispida, A. platyceras* and *A. corymbosa.* It differs from subsp. *corymbosa* in general aspect due to its smaller stature and greater average number of stems from the base, in its tendency to be less profusely branched at the top, and especially in its more deeply cut leaves. It is certainly deserving of at least subspecies rank.

A. corymbosa subsp. *arenicola* almost always occurs in actively moving or stabilized rust-colored sand. It is abundant at the type locality.

Specimens examined: UNITED STATES.

ARIZONA

Coconino Co.: Houserock Valley, *Eastwood & Howell* 6984 (CAS); in desert just w. of Lees Ferry, *McKelvey* 4448 (GH); Navajo Bridge to House Rock Valley, alt. 5100 ft., *Kearney & Peebles* 13622 (NY, US); 11.2 miles s. of "The Gap" (Hwy. 89), *Ownbey & Ownbey* 1813 (ARIZ, COLO, GH, MIN, NEW MEX, POM, RM, UC, UTC, US); 13.2 miles s. of Navajo Bridge, *Ownbey & Ownbey* 1814 (BRY, CAS, MIN, NY, RSA, WIS); 11.6 miles s.w. of Navajo Bridge, *Ownbey & Ownbey* 1815 (ARIZ, GH, MICH, MIN, OKL, SMU, WS); 21.8 miles s.w. of Navajo Bridge (Hwy. 89), *Ownbey & Ownbey* 1815a (COLO, K, MIN, TEX); 9.9 miles s.w. of Tuba City on road to Hwy. 89, *Ownbey & Ownbey* 2165 (ARIZ, CAS, COLO, GH, MIN, MO, RSA, SMU, UC, UTC, US, WS); near Navajo Bridge, alt. 3400 ft., *Peebles* 13019 (US); same locality, alt. 3900 ft., *Peebles* 13022 (US).

UTAH

Emery Co.: 37.9 miles s.w. of Green River on road to Hanksville, *Ownbey & Ownbey* 2146 (MIN, holotype of *A. corymbosa* subsp. *arenicola* Ownb.; isotypes, ARIZ, BRY, CAS, COLO, DAO, F, GH, K, MEXU, MICH, MIN, MO, NEW MEX, NY, OKL, POM, RM, RSA, SMU, TEX, UC, UTC, US, WS). Grand Co.: Grand River near Moab, *Jones s.n.* (CAS, GH, NY, US); 4.9 miles n.w. of Moab, Hwy. 160, *Ownbey & Ownbey* 2160 (ARIZ, GH, MIN, UTC); s. of Cisco, alt. 4100 ft., *Ripley & Barneby* 5414 (CAS). Iron Co.: Cedar Canyon, *Garrett* 6073 (RM), a doubtful record. Kane Co.: Kaiparowits Plateau, *Tompkins s.n.* (CAS). San Juan Co.: 4 miles s.w. of Bluff, *Ownbey & Ownbey* 2161 (MIN); 21.8 miles s.w. of Bluff, Hwy. 47, *Ownbey & Ownbey* 2164 (ARIZ, COLO, GH, K, MIN, MO, NY, POM, RM, UC, UTC, US).

20. ARGEMONE GRACILENTA Greene, in Pittonia 3: 346. 1898.

A. gracilenta Rose, in Contr. U. S. Nat. Herb. 8: 27. 1903.

A. albiflora Wats., in Proc. Am. Acad. 24: 38. 1888; not *A. albiflora* Hornem.

A. intermedia var. *typica* Prain, in Journ. Bot. 33: 363. 1895, in part; not *A. intermedia* Sweet.

A. intermedia var. *typica* Prain "ssp. *parviflora*" Prain, l.c., p. 364, nomen nudum; not *A. intermedia* Sweet.

A. platyceras var. *gracilenta* Fedde, in Pflanzenr. 4 (104): 285. 1909; Johnston, in Proc. Calif. Acad. 12: 1024. 1924; not *A. platyceras* L. & O.

A. intermedia Kearn. & Peeb., Fl. Pl. Ariz., p. 336. 1942, in part; Kearn. & Peeb., Ariz. Fl., p. 324. 1951, in part, as to Arizona; not *A. intermedia* Sweet.

Perennial with very pale yellow, almost white or rarely distinctly yellow latex; stems usually 1-6, 4-12 (-18) dm. tall, openly branched, moderately but conspicuously prickly throughout with usually very long, perpendicular prickles; leaves very glaucous, sublinear to elliptic-oblong, the basal ones to about 4 dm. long, often deeply lobed, the cauline sometimes deeply, but more often shallowly lobed, each marginal tooth terminated by a long, slender prickle, the lower surfaces of the leaves moderately prickly on the main veins, the upper surfaces very sparsely prickly on the midrib to entirely smooth; buds subspherical to oblong, the body 12-15 mm. broad, 15-18 mm. long, smaller during the dry season, sparingly prickly with perpendicular prickles, the sepal horns terete, usually long and slender, the length 8-12 (5-14) mm., usually wholly smooth but sometimes with 1 or 2 prickles near the base, the terminal spine elongate; flowers 6-9 cm. in diameter or smaller; petals white; stamens about 150, the filaments pale yellow, the anthers yellow; stigma purple, to about 4 mm. broad and 3 mm. high, often considerably smaller; capsules 3-4-carpellate, narrowly elliptical to narrowly elliptic-ovate, the body, exclusive of spines, 8-14 mm. broad, the length, including the stigma, 30-45 (-50) mm., sparingly armed with spreading spines, the longest of which is usually 6-8 (-10) mm.; seeds to 2 mm. long, often appreciably less. (Ill.: Fig. 21, 1-5; Dist.: Fig. 25.)

Lectotype: *Edward Palmer* 7, collected at Mulegé, Gulf of California, Baja California, Mexico, June, 1887 (ND; isotypes, DS, GH, NY US).

Habitat and distribution: Sandy and gravelly washes, outwash plains, dry, flat, eroded, desert terrain, west-central Arizona southward in the Sonoran Desert to Baja California del Sur, at elevations of near sea level to about 3000 ft., but mainly below 1000 ft.

Flowering and fruiting dates: In the north flowering begins about March 15 and first fruits mature about the end of April; in the south flowering begins about Feb. 1, and first fruits are matured early in March. Flowering and fruiting continues as conditions permit through November.

This species is distinguished by the nearly white latex, the ordinarily shallowly lobed or undulate-margined cauline leaves, the subspherical buds, the long, terete sepal horns which are usually totally smooth, and by the rather sparse, long and slender prickles of the stem.

When describing this species Greene made no mention of the similarity of the Mulegé specimens to the common prickly poppy of the Sonoran Desert. I can find no fundamental difference between the plants from Lower California and those from Sonora and Arizona and am, therefore, broadening the species circumscription to include these latter components.

There is considerable doubt of the genetic "purity" of *A. gracilenta* from certain localities in northern Sonora and Arizona. In southern Arizona and northern Sonora it appears to hybridize with *A. pleiacantha* subsp. *pleiacantha*, particularly in the vicinity of Tucson, Arizona. It

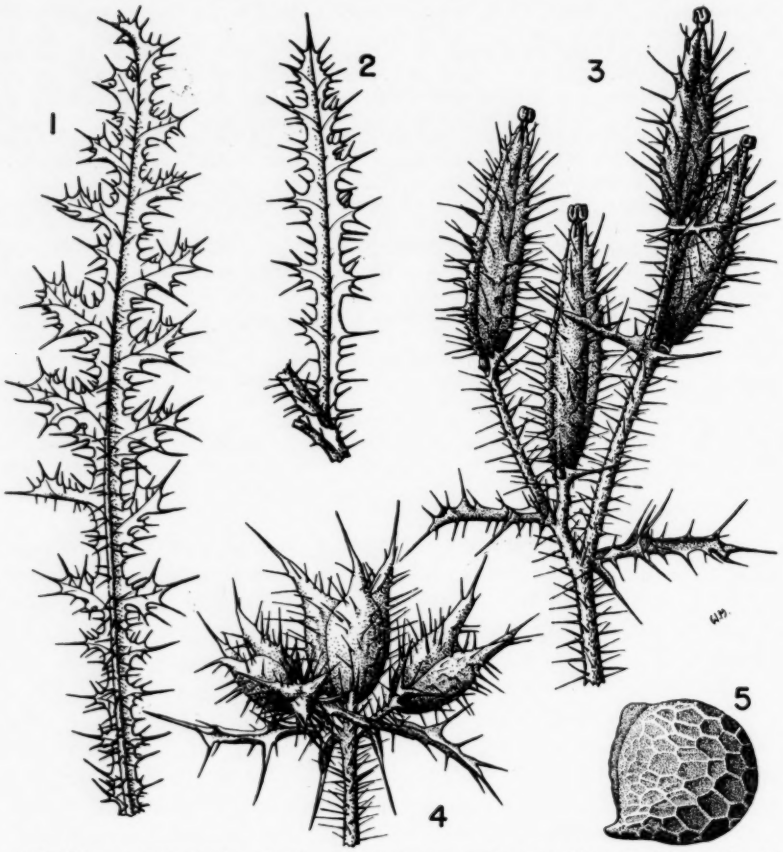

FIG. 21. *A. gracilenta.* 1. Basal leaf, under surface × ½. *Ownbey & Ownbey* 2087 (MIN). 2. Cauline leaf, upper surface × ½. *Ownbey & Ownbey* 2084 (MIN). 3. Capsules × 1. *Ownbey & Ownbey* 2079 (MIN). 4. Buds × 1. Same as 3. 5. Seed × 15. Topotype, *Johnston* 3665 (GH).

appears to hybridize with *A. pleiacantha* subsp. *ambigua* along the western periphery of the plateau region of central Arizona where the plateau drops off abruptly into the desert, that is, in Yavapai, northern Maricopa, and east-central Mojave counties. The fact that all three of these taxa are diploids lends credibility to an hypothesis of possible natural hybridization among them. For a further discussion see the text under *A. pleiacantha.* Over most of their ranges *A. gracilenta* and *A. pleiacantha* are well separated geographically and ecologically, and the two species are perfectly distinct.

The relationships of *A. gracilenta* to other species of *Argemone* are incompletely understood. In addition to a probable relationship to *A. pleiacantha* as indicated above, it is probably also rather closely related to *A. munita*, especially subspp. *munita* and *robusta*, and to other white-flowered species, e.g., *A. polyanthemos*.

In Prain's monograph the type collection of *A. gracilenta* is cited under *A. intermedia* var. *typica*. Following Greene's lead, however, Fedde recognized *A. gracilenta*, but reduced it to varietal status under *A. platyceras*, a view which cannot be supported on any grounds.

Specimens examined: UNITED STATES.

ARIZONA

Maricopa Co.: Agua Caliente, *Carlson s.n.* (CAS); 20.6 miles s. of Rock Springs, *Ownbey & Ownbey* 2099 (COLO, GH, MICH, MIN); 1.8 miles n.e. of Aguila, *Ownbey & Ownbey* 2109 (BRY, MEXU, MICH, MIN, NY, RM, SMU, UC, UTC); 5 miles e. of Gila Bend, alt. 680 ft., *Wolf* 2304 (CAS, DS, GH, RSA). Mohave Co.: Aquarius Mts., *Eastwood* 18377 (CAS). Pima Co.: desert w. of Tucson Mts., alt. about 2500 ft., *Graham s.n.* (NY, UC); fenced area, Santa Rita Forest Reserve, *Griffiths* 3858 (UC); near Tucson, *Peebles* 1564 (US); Tucson, *Rose* 11832 (NY, US); roadsides, Tucson, alt. 2400 ft., *Shreve* 10195 (DS, UC); mesas, Wilmot, alt. 2600 ft., *Thornber* 484 (MIN, MO, UC, US). Pinal Co.: roadside, Santan Mts., *Harrison & Kearney* 8683 (F); 7.3 miles s.e. of Picacho, *Ownbey & Ownbey* 1793 (ARIZ, CAS, COLO, GH, K, MIN, NY, RM, UC, US, UTC); 12.8 miles n. of Florence, *Ownbey & Ownbey* 1832 (MIN); Casa Grande, *Peebles & Harrison* 1867 (US). Yavapai Co.: 3.9 miles n.e. of Congress, *Ownbey & Ownbey* 2106 (ARIZ, CAS, MIN, NEW MEX, RM). Yuma Co.: 2.8 miles s.w. of Wenden, *Ownbey & Ownbey* 2110 (MIN).

MEXICO.

BAJA CALIFORNIA

Comondú, *Brandegee s.n.* (UC); 2 miles n. of Mulegé on the Santa Rosalía road, *Ferris* 8684 (DS, NY, POM, US); Mulegé, *Johnston* 3665 (CAS, GH, UC, US); middle w. side, Catalina Island, *Johnston* 4104 (CAS); Santa Catalina Island, *Moran* 3872 (DS); Mulegé, *Palmer* 7 (ND, lectotype of *A. gracilenta* Greene; isotypes, DS, GH, NY, US); Mulegé, *Rose* 16665 (NY, US); 11 miles e. of San Ignacio, *Wiggins* 7910 (DS, US).

SONORA

La Colorado, *Clokey* 1932 (UC); beside Guaymas road, about 3 km. s. of Villa de Seris, *Drouet & Richards* 3772 (DS, F); 43 km. (27 miles) n. of Hermosillo on road to Nogales, *Frye & Frye* 2293 (DS, GH, MO, NY, RM, RSA, UC, US); Ciudad Obregón, *Gentry* 277 (DS); near Picú Pass, *Long* 40 (US); Charco, s. of Sierra Blanca, *Lumholtz* 22 (GH); 2 miles s. of Hermosillo, *Ownbey & Ownbey* 1758 (GH, MEXU, MIN, NY, UC, US); 13.6 miles n. of Guaymas, *Ownbey & Ownbey* 1759 (ARIZ, CAS, GH, MEXU, MICH, MIN, MO, UC, US); 70.7 miles s. of Magdalena on road to Hermosillo, *Ownbey & Ownbey* 1761 (COLO, DAO, F, K, MEXU, MIN, NEW MEX, POM, WS); 13.2 miles s. of Santa Ana on road to Hermosillo, *Ownbey & Ownbey* 1762 (GH, MEXU, MIN); vicinity of Hermosillo, *Rose, Standley & Russell* 12373 (GH, NY, US); Los Ranchos, vicinity of Guaymas, *Rose, Standley & Russell* 15044 (NY, US); 11 miles e. of Willard between Hermosillo and Colorado, *Wiggins & Rollins* 296 (DS, MO, ND, GH, NY, US); about opposite Carbó on new highway, *Wiggins* 7527 (DS, US); 11 miles n. of San Pedro Rancho (16.9 miles n.w. of Tajitos), *Wiggins* 8300 (DS, UC, US).

21. ARGEMONE GRANDIFLORA Sweet, Brit. Fl. Gard. 3: t. 226. 1829.

Annual or short-lived perennial with yellow latex; stems 1-few, 3-12 (-15 or more) dm. tall, openly and widely branched, totally smooth to prickly throughout with scattered prickles (in subsp. *armata*); basal and lower cauline leaves deeply lobed, the middle and upper cauline progressively less deeply lobed and with fewer lobes, all the lobes with marginal lanceolate, prickle-tipped teeth, the lower surfaces of the leaves smooth or distantly prickly on the veins or (in subsp. *armata*) with a few stoutish prickles on the main veins, the upper surfaces smooth or with a few weak prickles on the main veins; buds subspherical, the body 12-17 mm. broad, 14-20 mm. long, smooth or armed with a few scattered, spreading prickles (especially in subsp. *armata*), the sepal horns terete, 7-15 mm. long, usually totally smooth, spine-tipped; flowers 6-10 cm. across, closely to distantly subtended by 1-2 bracteate leaves; petals white, suborbicular to broadly obovate-obcuneate; stamens at least 150, often many more, the filaments lemon-yellow, the anthers bright yellow; stigma purple, about 2.5-5.0 mm. wide and 1.5-3.0 mm. high; capsules 3-5-carpellate, broadly oblong to elliptical, the width, exclusive of armature, 10-18 mm., the length, including the stigma, 20-40 mm., armed with a few scattered, stoutish, spreading or recurved, even-sized spines and (in subsp. *armata*) sometimes with a few lesser spines and prickles, the largest spines about 5 (-8) mm. long, the capsular surface always clearly visible through the armature; seeds 1.8-2.2 mm. long.

Holotype: Sweet, l.c., states: "For the opportunity afforded us of giving a figure of this grand plant, we are obliged to the kindness of Robert Barclay, Esq. of Bury Hill, in whose superb collection it was raised this Spring, from seeds received from Mexico." Prain (1895, p. 333) notes that the "types" of Sweet's figures are preserved at Kew. There are, indeed, two sheets of *A. grandiflora*, cultivated in Barclay's garden, preserved at Kew. I know of no way positively to prove that these specimens actually represent those from which the original description and illustration were drawn, but the circumstantial evidence in favor of this view is strong. I have, therefore, designated these specimens the holotype. The exact identity of *A. grandiflora* can never be in doubt since the species was well illustrated in the original publication and in other journals of the period.

This species is easily separable into two components, viz., the historically well known *A. grandiflora* herein treated as subsp. *grandiflora*, and the previously undescribed subsp. *armata*. Distributionally, the latter subspecies occurs to the north of the former. Plants of the latter are, on the average, of much lower stature and have smaller leaves. These two subspecies have been studied extensively in the experimental garden by the writer. There appear to be no important sterility barriers between them under experimental conditions.

Key to the subspecies:

1. Stems smooth or with very few scattered prickles; leaves entirely smooth on both surfaces or distantly prickly on the veins beneath and rarely also with a very few prickles above ..... 21a. *A. grandiflora* subsp *grandiflora*

1. Stems prickly throughout with scattered prickles; lower surfaces of the leaves with a

few stoutish prickles on the main veins, the upper surfaces smooth or weakly prickly on the main veins ..... 21b. *A. grandiflora* subsp. *armata*

21a. ARGEMONE GRANDIFLORA Sweet subsp. GRANDIFLORA

A. grandiflora Sweet, Brit. Fl. Gard. 3: t. 226. 1829; Lindl., in Edwards's Bot. Reg. 15: t. 1264. 1829; Loddig., Bot. Cab. 16: t. 1546. 1829; Loud., in Gard. Mag. 6: 115. 1830; Loud., Hort. Brit., p. 216. 1830; Hook., in Curtis's Bot. Mag. 58: t. 3073. 1831; Otto & Dietr., in Allgem. Gartenzeit. 1: 300. 1833; Spach, Hist. Nat. Vég. 7: 27. 1839; Walp., Rep. 1: 110. 1842; Hemsl., Biol. Cent. Am., Bot. 1: 26. 1879; Prantl & Kündig, in Engl. & Prantl, Nat. Pflanzenf. 3 (2): 141. 1889; Prain, in Journ. Bot. 33: 332. 1895; Gray, Syn. Fl. N. Am. 1 (1): 87. 1895; Rose, in Contr. U. S. Nat. Herb. 8: 25. 1903; Fitzh., in Gard. Chron., third ser., 42: 113. 1907; Fedde, in Pflanzenr. 4 (104): 280, 274, fig. 36H, L. 1909.

A. mexicana Baillon, Hist. Pl. 3: 113, figs. 125-127. 1871, excluding fig. 127 which is undeterminable; not *A. mexicana* L.

Stems commonly 1, 6-12 (-15 or more) dm. tall, totally smooth or with a very few scattered prickles; lower cauline leaves often to 40 cm. or more long and 15 cm. or more wide, deeply lobed, the middle and upper leaves progressively smaller and more shallowly lobed, the marginal teeth of all the leaves large, few, broadly lanceolate, the leaf surfaces smooth or very distantly prickly on the veins beneath, usually totally smooth above; body of the buds about 13-17 mm. broad, 15-20 mm. long, smooth or sometimes with 1-4 weak prickles on each sepal, the sepal horns 7-15 mm. long, smooth; flowers 6-10 cm. across, usually not closely subtended by bracteate leaves; petals suborbicular to broadly obovate; stigma about 3-5 mm. wide and 2-3 mm. high; capsules broadly oblong-elliptic, the width, exclusive of spines, 10-18 mm., the length, including the stigma, 20-40 mm., armed with a few stout, spreading, subequal spines, the largest spines to about 5 mm. long, the capsular surface otherwise essentially smooth; seeds about 1.8-2.2 mm. long. (Ill.: Fig. 22, 1-3; Dist.: Fig. 25.)

Holotype: That of the species.

Habitat and distribution: Hills, mountains and adjacent flat lands, often in disturbed soils of roadways and around habitations at altitudes of near sea level to possibly 6000 ft. or more; east-central Mexico, Hidalgo to southern Tamaulipas. The species appears to be native in Hidalgo at intermediate elevations, and many of the peripheral records are surely introductions.

Flowering and fruiting dates: May be found in flower and fruit throughout the year; at higher elevations, however, the period of greatest abundance appears to be June, July and August.

This subspecies is best characterized by the near or complete lack of prickles on the leaf surfaces and stem, by the subspherical, smooth or nearly smooth buds with long sepal horns, and by the sparingly spinescent capsules. It is perhaps the most distinctive of all of the white-flowered forms of *Argemone*.

Specimens examined: MEXICO.

HIDALGO

Jacala, alt. 4500 ft., *Chase* 7102 (F, GH, MO, NY); vicinity of Zimapán, *Kenoyer* 1035 (GH); 18.5 miles n.e. of Jacala, *Ownbey & Ownbey* 1419 (F, GH, MEXU, MIN, NY, UC, US); 9 miles n. of Zimapán, *Ownbey & Ownbey* 1420 (CAS, K, MICH, MIN,

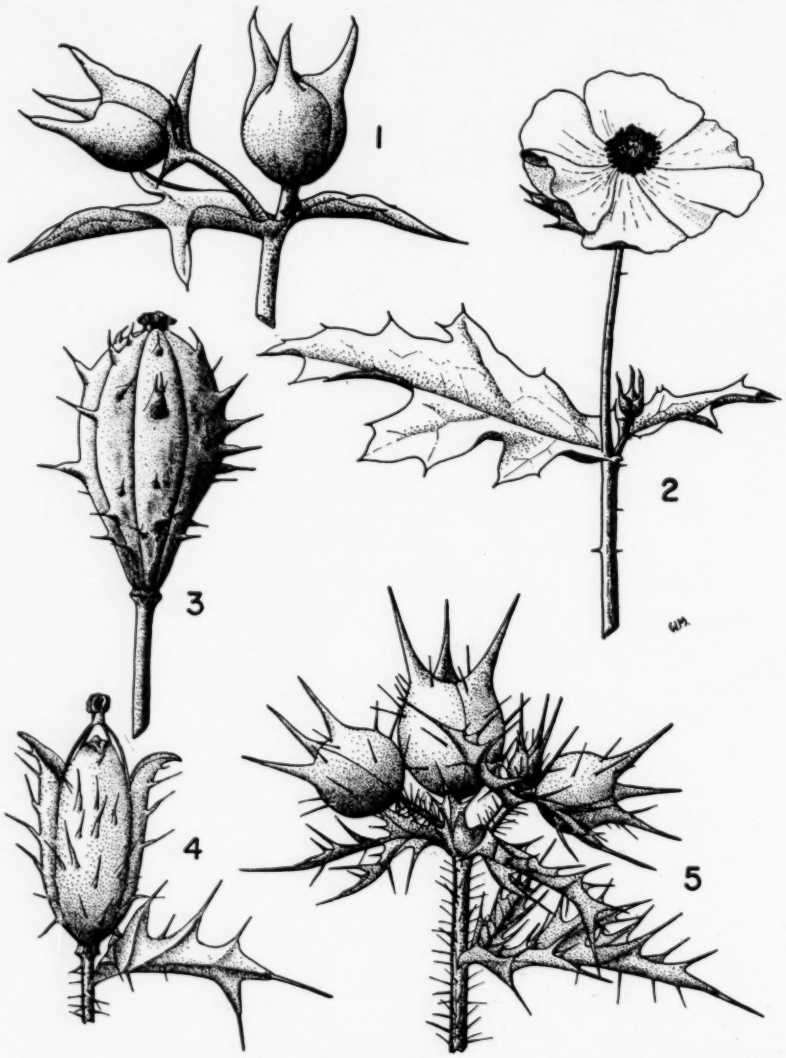

FIG. 22. 1-3. *A. grandiflora* subsp. *grandiflora*. 1. Buds × 1. Cult. from seeds collected at El Pinalito, Hidalgo, *Straw* M18 (MIN). 2. Flower × ½. Same as 1. 3. Fruit × 1. Same as 1. 4-5. *A. grandiflora* subsp. *armata*. 4. Capsule × 1. Holotype, *Palmer* 57, *in part* (US). 5. Buds × 1. *Ownbey & Ownbey* 1411 (MIN).

MO); 6.6 miles n.e. of Jacala, *Ownbey & Ownbey* 2047 (MIN); Sierra de la Mesa, *Rose, Painter & Rose* 9116 (GH, US).

QUERÉTARO

Between Higuerillas and San Pablo, *Rose, Painter & Rose* 9812 (US).

SAN LUIS POTOSÍ

Near Tanquián, *Loesener* 264 (GH, US); near Tancanhuitz, *Nelson* 4408 (GH, US); 14 miles n.w. of Ciudad del Maíz, *Ownbey & Ownbey* 2043 (COLO, GH, K, MEXU, MIN, NY, POM, RM, UC, US, WS); 13.3 miles w. of Río Verde, *Robinson* 64 (US).

TAMAULIPAS

Gómez Farías, *Harrell* 362 (MIN); El Limón, *Ownbey & Ownbey* 1415 (GH, MEXU, MIN); vicinity of La Barra, 8 km. e. of Tampico, *Palmer* 303 (CAS, F, GH, MO, NY, US).

21b. ARGEMONE GRANDIFLORA Sweet subsp. **armata** G. B. Ownb., subsp. nov.

A. intermedia Fedde, in Pflanzenr. 4 (104): 281. 1909, in part; not *A. intermedia* Sweet.

Herba annua. Caules omnino aculeati aculeis dispersis. Folia subter in venis principalibus aculeata supra in venis inermia aut sparse aculeata. Alabastra subglobosa aculeis paucis et dispersis armata, petalis albis. Capsulae oblongae vel late aut anguste ellipticae, spinis robustis patentibus aut reflexis armatae. Semina circa 2.0-2.2 mm. longa.

Stems 1-few, 3-7 dm. tall, prickly throughout with scattered prickles; leaves commonly lobed one-half to three-fourths the distance to the midrib, the lobes lanceolate, the leaf surfaces with a few stout prickles on the main veins beneath, smooth or with a few weak prickles on the main veins above; body of the buds 12-16 mm. broad, 14-18 mm. long, armed with a few scattered, spreading prickles mainly on the upper half, the sepal horns 7-12 mm. long, usually totally smooth; flowers 7-10 cm. across, usually closely subtended by 1-2 bracteate leaves; petals obovate-obcuneate; stigma about 2.5-4.0 mm. wide, 1.5-2.5 mm. high; capsules typically oblong, sometimes broadly to narrowly elliptical, the width, exclusive of armature, 12-16 mm., the length, including the stigma, 25-40 (20-) mm., armed with scattered, stout, spreading or recurved, even-sized spines and sometimes also with a few lesser spines and prickles, the largest spines 6-8 mm. long; seeds about 2.0-2.2 mm. long. (Ill.: Fig. 22, 4-5; Dist.: Fig. 25.)

Holotype: *Dr. Edward Palmer* 57, *in part*, collected in the vicinity of Victoria, altitude about 320 meters, Tamaulipas, Mexico, Feb. 1 to April 9, 1907 (US; isotypes, F, GH, K, MO, NY).

Habitat and distribution: Fields and waste places, disturbed soil, Tamaulipas, Nuevo León and southern Coahuila, Mexico; in Coahuila almost certainly by introduction; at elevations of 1000-4000 ft.

Flowering and fruiting dates: Only fragmentary information is available; flowering specimens have been collected from March to October; fruiting specimens have been collected from June onward.

This subspecies is best characterized by the distantly prickly stems and by the presence of prickles on the main veins of the under surfaces of the leaves. It is separated from other white-flowered Mexican species of *Argemone* by means of the subspherical, sparingly prickly buds with

long, terete sepal horns and by the armature of the capsules which consists almost entirely of large spines, there being few if any lesser spines and prickles.

Specimens examined: MEXICO.

COAHUILA

2.1 miles w. of San Pedro, *Ownbey & Ownbey* 1449 (MIN, UC).

NUEVO LEÓN

Río Sta. Catarina, Monterrey, *Abbon & Arsène* 6233 (US); outskirts of Sta. Catarina, *Ownbey & Ownbey* 1406 (GH, MIN, NY, US).

TAMAULIPAS

Hacienda Santa Engracia, 40 miles n.w. of C. Victoria, alt. 240 m., *Meyer & Rogers* 2836, *in part* (MIN, MO); 22.3 miles n.w. of C. Victoria, *Ownbey & Ownbey* 1411 (MIN); vicinity of Victoria, alt. 320 m., *Palmer* 57, in part (US, holotype of *A. grandiflora* subsp. *armata* Ownb.; isotypes, F, GH, K, MO, NY); Güémez, alt. 600 m., *Runyon* 732 (US); river valley near Nogales, Jaumave, *von Rozynski* 69 (F).

22. ARGEMONE **polyanthemos** (Fedde) G. B. Ownb., stat. nov.

A. intermedia var. *polyanthemos* Fedde, in Pflanzenr. 4 (104): 283. 1909; not *A. intermedia* Sweet.

A. alba James, Long's Exped. 1: 461. 1823; Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, as to Nebraska distribution; Rydb., Fl. Black Hills, in Contr. U. S. Nat. Herb. 3: 483. 1896; Britton & Brown, Ill. Fl. 2: 101. 1897, as to Great Plains distribution; Stemen & Myers, Okla. Fl., p. 162. 1937; not *A. alba* Lestib; not *A. alba* Raf.

A. mexicana James, in Trans. Am. Phil. Soc., n.s., 2: 183. 1825; Torrey in Emory, Notes Mil. Rec. Ft. Leavenw. to San Diego, p. 406. 1848; Torrey, in Pac. R. Rep. 4 (5): 64. 1856; Port. & Coult., Syn. Fl. Colo., p. 6. 1874, in part; not *A. mexicana* L.

A. mexicana β *albiflora* Torrey, in Ann. Lyc. Nat. Hist. N. Y. 2: 166. 1828; Torrey, in Fremont, Rep., p. 87. 1845; Kuntze, Rev. Gen. 1: 12. 1891, as to Colorado distribution; not *A. mexicana* β *albiflora* DC.; not *A. mexicana* L.; not *A. albiflora* Hornem.

A. mexicana var. *albiflora* Gray, in Pac. R. Rep. 12 (2): 40. 1860; not *A. mexicana* L.; not *A. albiflora* Hornem.

A. hispida Hook., in Curtis's Bot. Mag. 104: t. 6402. 1878, as to plant figured; not *A. hispida* Gray.

A. platyceras Coult., Man., p. 13. 1885, in part; Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; Harrington, Man. Pl. Colo., p. 252. 1954, as to Wyoming, Colorado and Nebraska distributions; not *A. platyceras* L. & O.

A. albiflora Rydb., Fl. Sand Hills, in Contr. U. S. Nat. Herb. 3: 149. 1895; not *A. albiflora* Hornem.

A. intermedia var. *typica* Prain, in Journ. Bot. 33: 363. 1895, in part; not *A. intermedia* Sweet.

A. intermedia Eastwood, in Erythea 4: 96. 1896, as to Colorado distribution; Brit., Man., p. 439. 1901, as to Great Plains distribution; Nels., Analyt. Key Fl. Pl. Rocky Mt. Reg., p. 27. 1902; Small, Fl. s.e. U. S., p. 462. 1903, as to Great Plains distribution; Rydb., Fl. Colo., p. 149. 1906, excluding Mexico distributions; Robins. & Fern., Gray's Man., ed. 7, p. 416. 1908, excluding Illinois specimen; Coult. & Nels., New Man. Bot., p. 206. 1909; Fedde, in Pflanzenr. 4 (104): 281, in part, p. 274, fig. 36J, K. 1909; Nelson, Sp. Fl., p. 59. 1912; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, as to Great Plains distribution; Woot. & Standl., Fl. N. Mex., in Contr. U. S. Nat. Herb. 19: 261. 1915, as to New Mexico distribution; Rydb., Fl. R. Mts., p. 318. 1917, excluding Mexico and Utah distributions; Peters., Fl. Nebr., ed. 3, p. 67. 1923; Over, Fl. S. Dak.,

p. 50. 1932; Rydb., Fl. Pr. & Pl., p. 353. 1932, excluding Missouri and Mexico distributions; Stemen & Myers, Okla. Fl., p. 162. 1937; Gates, Fl. Kans., p. 156. 1940; Stevens, Kans. Wild Fl., p. 116. 1948; Fernald, Gray's Man., ed. 8, p. 681. 1950, excluding Illinois and Missouri distributions; Gleason, New Ill. Fl. 2: 199. 1952, as to Great Plains distribution; Weber, Handb. Pl. Colo. Fr. R., p. 106. 1953; Harringt., Man. Pl. Colo., p. 252. 1954, excluding Arizona distribution; not *A. intermedia* Sweet.

Annual or biennial with a deep tap root and bright yellow latex; stems 1-5, 4-8 (-12) dm. tall, cymosely branched, sparingly prickly with stout, perpendicular or recurved prickles; leaves glaucous, succulent, the lower ones oblanceolate, lobed to two-thirds the distance to the midrib, the lobes oblong, the middle and upper ones elliptic-ovate, more shallowly lobed, the uppermost definitely clasping the stem, the leaf surfaces with scattered, perpendicular or recurved prickles on the main veins below, totally smooth above; buds elliptic-oblong, the body 10-15 mm. broad, 15-22 mm. long, rather sparingly to moderately prickly with spreading prickles, the sepal horns essentially terete, 6-10 (-15) mm. long, usually completely devoid of prickles; flowers ordinarily 7-10 cm. in diameter, usually rather closely subtended by 1-2 foliar bracts, but sometimes the bracts distant; petals white, very rarely lavender, the inner broadly obovate-obcuneate, the outer suborbicular, the outer margins minutely erose; stamens numerous, 150 or more, the filaments lemon-yellow, the anthers bright yellow, equalling the stigma in length at anthesis; stigma purple, 3.0-4.5 mm. broad, 2.0-3.0 mm. high, 3-4-lobed; capsules 3-4-carpellate, narrowly to broadly elliptical, the width, exclusive of armature, 10-15 (-17) mm., the length, including the stigma, 35-50 (30-) mm., stoutly spinescent with widely spaced, spreading or recurved, simple spines, the largest of which are about 8-10 mm. long, these commonly interspersed with a few smaller ones, the capsular surface clearly visible; seeds about 2 mm. long. (Ill.: Fig. 23, 1-3; Dist.: Fig. 25.)

Holotype: *James Mooney s.n.*, collected on the Kiowa Reservation, Caddo Co., Oklahoma, Aug. 15, 1895 (US; isotype, F, fruits only).

Habitat and distribution: Prairies, foothills, and mesas, sandy or gravelly soils, roadsides, fields, pastures, waste ground; generally distributed from the eastern base of the Rocky Mountains across the plains from southwestern South Dakota, eastern Wyoming to New Mexico and Texas. Outlying localities are found in Montana, Utah (doubtless by introduction), western Colorado, southern New Mexico, and east-central Texas (doubtless by introduction). The species is found at elevations of less than 1000 ft. in eastern Kansas and Texas to over 7000 ft. in Colorado and New Mexico, but over most of its range it grows at elevations of 3000 to 6000 ft.

Flowering and fruiting dates: At lower elevations to the south flowering may begin by April 15, at higher elevations to the north it may be delayed to June 15 or later; flowering continues as local conditions permit through the summer; fruits begin to mature about a month after first flowering and continue to mature until late September or early October.

A. polyanthemos is distinguished by the sparingly prickly stems, the succulent, usually shallowly lobed leaves which are devoid of prickles on their upper surfaces, the upper ones usually clasping, and by the stoutly but usually distantly spinescent, elliptical capsules. The species is closely related to *A. albiflora* Hornem., and treated more conservatively, *A. poly-*

FIG. 23. *A. polyanthemos.* 1. Habit × 1. *Osterhout s.n.* (RM 31119). 2. Capsule × 1. Cult. from seeds of *Ownbey & Ownbey* 1323 (MIN). 3. Bud × 1. Same as 1.

anthemos would probably be made a subspecies of the latter. It differs from *A. albiflora* subsp. *albiflora*, however, in the narrowly elliptical rather than broadly oblong capsules, the usually longer and more numerous stamens, longer sepal horns, denser foliage and shorter stature. *A. polyanthemos* differs from *A. albiflora* subsp. *texana* in its ordinarily much less prickly capsules, less prickly stems, more glaucous leaves of thicker texture, and lower stature. It appears to hybridize with the latter subspecies in eastern Texas where *A. polyanthemos* is probably introduced and ephemeral in pure state. A fair percentage of specimens from this area can be placed only with reservations with either species. Also, there

appears to be some influence of *A. albiflora* subsp. *texana* on *A. polyanthemos* in northern Texas and adjacent Oklahoma but this influence grows less pronounced as the distance from the natural area of *A. albiflora* increases. This presumed introgression is evidenced by more prickly buds and capsules as well as by leaves of intermediate character in specimens of suspected hybrid ancestry.

It is regrettable that a new name must be introduced for the well-known plant of the western plains which for many decades has been called *A. intermedia* Sweet by American botanists. The exact identity of *A. intermedia* has yet to be determined, but it seems certain that it is not conspecific with *A. polyanthemos.* The former was described from plants grown from seeds from Mexico; the latter is not found outside the United States. The presence in Mexico of argemones which in the past have been lumped with *A. polyanthemos* under the binomial *A. intermedia,* even when the original application of *A. intermedia* was unclear has led to much confusion. The important fact to be emphasized here is that the name *A. intermedia* is a nomen confusum which cannot be applied to any species of *Argemone* with assurance. Even though its true identity may ultimately be determined the name cannot be applied, on distributional grounds, to the taxon native to the western Great Plains and foothills of the Rocky Mountains.

As originally proposed, *A. intermedia* var. *polyanthemos* Fedde was superfluous since the variety is indistinguishable from other specimens from the Great Plains cited by Fedde under *A. intermedia* proper. As a result of the rejection of the name *A. intermedia* for the Great Plains plant, however, Fedde's varietal epithet becomes available for the species. The application of the name is manifestly far broader than originally intended, but in this way the introduction of an entirely new name is avoided. Only one specimen is cited in the original description of var. *polyanthemos,* viz., *Mooney s.n.* from the Kiowa Reservation, Oklahoma, 1895. A specimen bearing these data and annotated by Fedde as his variety is deposited at the U. S. National Herbarium. Presumably this is the holotype.

Exactly which species of *Argemone* was introduced into England in 1828 and named *A. intermedia* by Sweet remains obscure. The species was not illustrated anywhere and as nearly as I can ascertain no specimens were preserved; at any rate no specimens from this period of authentic *A. intermedia* seem to be available at Kew. Prain makes no mention of any such specimens in any of the herbaria consulted in preparation of his revision, nor are his reasons for taking up the name clear. As is pointed out below *A. intermedia* var. *typica* of Prain contains many diverse elements which have in common white or pink petals and a paucity of spines on the foliage and stems. If one could overlook the stated geographical

origin of *A. intermedia* Sweet it is conceivable that it might really be conspecific with *A. polyanthemos*. There were certainly countless opportunities for the introduction of seeds from the United States prior to 1828.

Several taxa were included by Prain under *A. intermedia* var. *typica*. These are *A. corymbosa, A. gracilenta, A. polyanthemos* and *A. sanguinea,* as to specimens cited. Except for *A. corymbosa,* these were published subsequently to Prain's revision. His limited understanding of these taxa may unquestionably be ascribed to a deficiency of specimens in European herbaria. Under the circumstances, his reluctance to propose new names is commendable.

In Fedde's monograph, the typical element of *A. intermedia* is even more diverse, judging from the specimens cited. Elements of *A. albiflora* subsp. *texana, A. arida, A. grandiflora* subsp. *armata, A. munita* subsp. *munita, A. polyanthemos* and *A. sanguinea* are included. Fedde's treatment is an advance over that of Prain in that *A. corymbosa* is given varietal status and *A. gracilenta* is removed entirely from this complex. Some specimens of *A. polyanthemos* were also cited by Fedde under *A. platyceras.*

A species which without question is *A. polyanthemos* was introduced into Europe in 1877 by means of seeds collected by J. D. Hooker in Colorado. They were grown at Kew and figured in Curtis's Botanical Magazine in 1878 under the name *A. hispida* Gray. The plate excellently represents *A. polyanthemos* except for the stigma which is incorrectly drawn. In Hooker's discussion the species is confused with true *A. hispida* as might be expected, and with *A. munita.*

Prain erred in assigning his var. *stenopetala* to A. *intermedia* Sweet, a point of view subsequently adopted by Fedde. I have collected and studied this taxon in the field and am convinced that it is more closely allied to *A. ochroleuca* than to any of the white-flowered argemones. Rose, who was thoroughly familiar with Mexican *Argemone,* raised Prain's variety to species rank, certainly a more acceptable viewpoint. I choose to treat the taxon as a subspecies of *A. ochroleuca* for reasons discussed under that species.

A. alba James is validly although very casually published. It applies without doubt to the same taxon as *A. polyanthemos. A. alba* James is, fortunately, a later homonym of *A. alba* Raf. which in turn is a synonym of *A. albiflora* Hornem. We are thereby freed from any eventuality which might require the revival of *A. alba* James, a step which would unavoidably lead to confusion.

Specimens examined: UNITED STATES.

COLORADO

Boulder Co.: near Bounder, alt. 5000-6000 ft., *Tweedy* 4966 (NY, RM). Cheyenne Co.: 1.3 miles s. of Kit Carson, *Ownbey & Ownbey* 1703 (MIN). Clear Creek Co.: .2 mile w. of Dumont, *Ownbey & Ownbey* 1314 (COLO, MIN). Denver Co.: North Denver, *Eastwood* 39a (CAS, GH, MO, UC, US). Elbert Co.: 7 miles w. of Limon, *Ownbey* 1310 (GH, MO, NY, RM, UC). El Paso Co.: Manitou, alt. 2100 m., *Clements & Clements* 5 (DS, GH, MIN, MO, NY, RM, US). Jefferson Co.: 10 miles w. of Denver, *Nelson* 10953 (DS, MO, RM). Larimer Co.: about 20 miles n. of Ft. Collins, Hwy. 287, *Ownbey & Ownbey* 1311 (ARIZ, BM, CAS, COLO, GH, MIN, NEW MEX, RM); Ft. Collins, alt. 5500 ft., *Sheldon* 28 (F, NY, US). Las Animas Co.: Starkville, *Ownbey & Ownbey* 1486 (ARIZ, COLO, GH, MICH, MIN, RM); 2 miles w. of Carrizo Mt., *Rogers* 6192 (TEX). Lincoln Co.: 10.5 miles s.e. of Hugo, *Ownbey & Ownbey* 1701 (MIN). Montrose Co.: Black Canyon, region of Gunnison watershed, alt. 7075 ft., *Baker* 699 (GH, MIN, MO, ND, NY, POM, RM, UC, US). Pueblo Co.: Pueblo, *Woodward s.n.* (GH). Weid Co.: New Windsor, *Osterhout* 2317 (NY, RM, US); 3.2 miles s.w. of Roggen, Hwy. 6, *Ownbey & Ownbey* 1317 (COLO, MIN, UC, US).

KANSAS

Barton Co.: no locality, *Hitchcock s.n.* (KSC). Cheyenne Co.: no locality, *White s.n.* (KSC). Clark Co.: 8 miles s. of Sitka, *Rydberg & Imler* 1123 (KANU, NY). Edwards Co.: no locality, *Finch* 84 (KSC, MO). Elk Co.: no locality, *Clothier & Whitford s.n.* (KSC). Ellis Co.: no locality, *Zeller s.n.* (MO). Ford Co.: 3 miles s. of Dodge City, alt. 2480 ft., *Horr* 3425 (GH, KANU, TEX). Geary Co.: n. of Alida, *Gates* 21247 (MIN, RM). Gove Co.: no locality, *Hitchcock s.n.* (KSC). Greeley Co.: 14.4 miles s. of Tribune, *Ownbey & Ownbey* 1673 (ILL, KSC, MIN, RM, SMU). Kearney Co.: no locality, *Hitchcock s.n.* (KSC). Kiowa Co.: near Haviland, *Frame s.n.* (US). McPherson Co.: near Lindsborg, *Bodin s.n.* (MIN). Norton Co.: Norton, *Smyth* 37 (KSC, NY). Osborne Co.: Osborne City, *Shear* 77 (F, GH, NY, RM, US). Ottawa Co.: no locality, *Hitchcock s.n.* (KSC). Pratt Co.: Turkey Creek, *Norris s.n.* (MO). Reno Co.: Hutchinson, *Smyth* 32 (F, NY, US). Republic Co.: Scandia, *Thomas s.n.* (KSC). Riley Co.: no locality, *Norton* 12 (GH, KSC, MO, NY, RM, US). Rooks Co.: Rockport, *Bartholomew s.n.* (MO). Shawnee Co.: 7 miles e. of Topeka, alt. 875 ft., *Horr* E220 (CAS, KANU, MIN, RM, TEX, US). Sumner Co.: no locality, *Clothier & Whitford s.n.* (KSC). Thomas Co.: no locality, *Hitchcock s.n.* (KSC). Washington Co.: 1 mile and 2 miles w. of Washington, *Horr* 4628 (KANU). County Uncertain: Republ. Fork of Kansas, *Engelmann s.n.* (MO); n.w. Kansas, *Rusby s.n.* (US).

MONTANA

Dawson Co.: Riverside, *Seymour s.n.* (GH). Treasure Co.: Myers, *Barnhart* 218 (NY); Hysham, *Hiller s. n.* (MIN). Yellowstone Co.: Custer, *Blankinship s.n.* (ND). County Uncertain: Upper Yellowstone, *Havard s.n.* (US).

NEBRASKA

Cherry Co.: 10 miles s.e. of Valentine, *Ownbey & Ownbey* 1554 (MIN). Cheyenne Co.: Sidney, alt. 4090 ft., *Blackwood* 3500 (GH). Custer Co.: Callaway, *Bates s.n.* (GH). Dawes Co.: White River near Crawford, alt. 1200 m., *MacDougal* 117 (NY). Deuel Co.: no locality, *Rydberg s.n.* (US). Franklin Co.: Franklin, *Hapeman s.n.* (CAS, UC). Hooker Co.: near Mullen, *Rydberg* 1358, *in part* (US). Keith Co.: Ogallala, *Hapeman s.n.* (MIN). Knox Co.: Niobrara, *Clements* 2706 (GH, MIN, NY, US). Lincoln Co.: forks of Platte, *Engelmann s.n.* (MO); 7.9 miles n.w. of Gothenburg, Hwy. 30, *Ownbey & Ownbey* 1323 (BM, CAS, GH, MIN, NY, RM, SMU). Morrill Co.: Bayard, *Hapeman s.n.* (MO). Nuckolls Co.: no locality, *Hedgecock s.n.* (MO). Redwillow Co.: e. of McCook, *Mathias* 320 (MO, POM). Saunders Co.: Ashland, *Williams s.n.* (US).

Sheridan Co.: no locality, *Hatcher s.n.* (UC). Sioux Co.: no locality, *Kramer* 113 (MO). Thomas Co.: Dismal River s. of Thedford, *Rydberg* 1358, *in part* (NY, US). Webster Co.: Red Cloud, *Bates s.n.* (GH). County Uncertain: Bad Lands, *Hayden s.n.* (MO); South Fork, *Hayden s.n.* (MO).

New Mexico

Curry Co.: 18.5 miles n. of Clovis, *Ownbey & Ownbey* 1738 (GH, MIN, NEW MEX, NY, RM, UC). Dona Ana Co.: 6.4 miles n.e. of Organ, *Ownbey & Ownbey* 1756 (ARIZ, BM, CAS, COLO, F, GH, MICH, MIN, NEW MEX, NY, POM, RM, SMU, TEX, UC, UTC, US); Organ Mts., *Vasey s.n.* (F, US); Organ Mts., alt. 5000 ft., *Wooton* 147 (KSC, MIN, MO, ND, NY, POM, RM, US). San Miguel Co.: Las Vegas, alt. 1850 m., *Arsène* 18394 (US). Santa Fe Co.: Walnut Creek, *Fendler* 20 (MO); 6 miles s.e. of Santa Fe, Hwy. 285, *Ownbey & Ownbey* 1482 (ARIZ, CAS, COLO, MIN, NEW MEX, NY, RM, SMU); near Glorieta, alt. 7300 ft., *Standley* 5205 (GH, MO, NY, US). Union Co.: 3.5 miles s. of Clayton, *Ownbey & Ownbey* 1737 (MIN).

Oklahoma

Alfalfa Co.: Aline, *Stevens* 803 (DS, GH, MIN, MO, NY, SMU, US). Caddo Co.: Kiowa Reservation, *Mooney s.n.* (US, holotype of *A. intermedia* var. *polyanthemos* Fedde; isotype, F). Cleveland Co.: Norman, *Emig* 358 (MO). Comanche Co.: Fort Sill, *Clemens* 11588 (MO). Harmon Co.: Hollis, *Stevens* 1072 (GH, MIN). Kingfisher Co.: Huntsville, *Blankinship s.n.* (GH). Logan Co.: near Langston, *Myers s.n.* (MIN). McClain Co.: 2 miles s. of Purcell, *Stout* 21 (RM). Marshall Co.: .5 mile w. of UOBS, *Riggs s.n.* (SMU). Oklahoma Co.: Oklahoma City, *Shimek s.n.* (F, MO). Payne Co.: 9 miles w. of Stillwater, *McAlister* 70 (CAS). Roger Mills Co.: Antelope Hills, *Goodman* 4331 (TEX). Tillman Co.: Frederick, *Duncan* 17 (MO). Woods Co.: no locality, *White s.n.* (RM). County Uncertain: Deer Creek, *Bigelow s.n.* (US); Indian Territory, *Palmer* 8 (US).

South Dakota

Bennett Co.: Martin, *Moore* 847 (MIN). Custer Co.: Buffalo Gap, *Hayward* 2563 (F, RM); Hermosa, alt. 3500 ft., *Rydberg* 511 (NY, US). Fall River Co.: near Hot Springs, *Palmer* 37449 (GH, MO). Meade Co.: Tilford, *McIntosh* 467 (RM). Mellette Co.: White River, *Wallace* 101 (NY). Pennington Co.: Rapid City, *Lee* 442 (RM). Washabaugh Co.: Bear Creek, *Visher* 2044 (F, NY).

Texas

Anderson Co.: Palestine, *Eggert s.n.* (MO). Archer Co.: 2 miles w. of Archer City, *Shinners* 18549 (SMU). Bell Co.: 3 miles n.w. of Temple, *Wolff* 909 (US). Burnet Co.: along Colorado River, *Wolff* 3224 (US). Callahan Co.: Baird, *Palmer* 13691 (MO). Childress Co.: 19 miles n. of Childress, *Whitehouse* 18705 (SMU). Clay Co.: 11.8 miles s. of Petrolia, Hwy. 148, *Whitehouse* 10835 (SMU). Collin Co.: 4 miles n. of Celina, *Timmons* 734 (NY). Dallas Co.: Dallas, *Hynes s.n.* (TEX). Fannin Co.: Bonham, *Milligan s.n.* (US). Fisher Co.: Grady, *Shepherd s.n.* (US). Hall Co.: Estelline, *Reverchon s.n.* (MO). Hemphill Co.: Canadian, *Condit s.n.* (UC). Hutchinson Co.: Fritch, *Shepard* 51 (TEX). Johnson Co.: 13.5 miles s.w. of Cleburne, *Shinners* 11267 (SMU). Lipscomb Co.: Lipscomb, *Howell* 25 (US). Lubbock Co.: Lubbock, *Studhalter* 1244 (US). McLennan Co.: n. of Lake Waco, *Smith* 42 (TEX). Mills Co.: Goldthwaite, *Morgan s.n.* (NY, TEX). Mitchell Co.: Colorado, *Hooks* 15269 (GH). Montgomery Co.: no locality, *Dixon* 495 (GH, NY). Nolan Co.: Sweetwater, *Stanfield* 4 (TEX). Palo Pinto Co.: Brazos, *Wadsworth s.n.* (TEX). Parker Co.: Millsap, *Wadsworth s.n.* (TEX). Potter Co.: Amarillo, *Reverchon s.n.* (MO). Randall Co.: Canyon, *Palmer* 14039 (MO, US). Tarrant Co.: Fort Worth, *Ruth s.n.* (US); Fort Worth, *Ruth s.n.* (NY); Fort Worth, *Ruth s.n.* (MO). Taylor Co.: Camp Barkeley, *Tolstead* 7136 (TEX, UC). Wheeler Co.: Shamrock, *Tharp* 4368 (TEX). Wilbarger

Co.: Vernon, *Reverchon* 3706 (MO). Williamson Co.: Brushy Creek, *Whitehouse* 18693 (SMU). Young Co.: 3 miles s.e. of Olney, *Cory* 13105 (GH).

UTAH

Salt Lake Co.: 3 miles s. of Beck's Hot Springs, alt. 4250 ft., *Garrett* 8615 (UC).

WYOMING

Albany Co.: Halleck Canyon, *Nelson* 7424 (GH, MIN, MO, NY, POM, RM, US). Converse Co.: Red (i.e., Bed) Tick Creek, *Nelson* 5042 (MO, NY, RM). Goshen Co.: near Lingle, *Ownbey & Ownbey* 1303 (MIN, RM). Platte Co.: Badger, *Nelson* 2102 (GH, MO, NY, RM); 1.7 miles n. of Wheatland, *Ownbey & Ownbey* 1305 (GH, MIN, OKL, RM). Weston Co.: Newcastle, *Hayward* 2050 (F, RM).

STATE UNCERTAIN

Fremont's Exped. to Calif., *Fremont s.n.* (GH).

23. ARGEMONE ALBIFLORA Hornem., Hort. Hafn., p. 489. 1815.

Annual or biennial with a deep tap root and yellow latex; stems usually 1, 4-10 (-15) dm. tall, often much branched, sparsely to rather moderately prickly; leaves pale glaucous or greenish, the basal and lower cauline oblanceolate, lobed from one-half to four-fifths the distance to the midrib, the lobes oblong, the middle and upper ones more shallowly lobed, the broad bases of the uppermost clasping, the leaf margins with acute teeth, the leaf surfaces sparingly prickly on the main veins below, totally smooth or rarely with a few weak prickles on the main veins above; buds broadly elliptical to subspherical, the body 10-16 mm. broad, 12-18 mm. long, sparingly to rather closely prickly, the sepal horns terete, 3-6 (-10) mm. long, usually smooth; flowers 5-10 cm. in diameter, rather closely to quite distantly subtended by 1-2 foliar bracts; petals white (rarely lavender ?), the outer ones suborbicular, the inner ones obovate-obcuneate, minutely erose on the outer margin; stamens 150 or more, the filaments lemon-yellow, the anthers yellow, equal to or shorter than the pistil at anthesis; stigma purple, 2-4 mm. broad, 1.5-3.0 mm. high; style sometimes evident; capsules 4-5 (3-7) -carpellate, narrowly elliptical to oblong-elliptic or oblong, the width, exclusive of spines, 10-15 (-25) mm., the length, including the stigma, 20-40 (-45) mm., stoutly armed with even-sized spines to more closely armed with large spines interspersed with smaller, uneven-sized spines and prickles, the largest spines 6-10 (-12) mm. long, the capsular surface clearly visible or partially obscured; seeds about 1.6-2.0 mm. long.

Lectotype: A cultivated specimen from Hornemann's herbarium labeled *Argemone albiflora* Hornem. in his handwriting (C).

In J. W. Hornemann's listing of the plants in the Royal Botanic Garden of Copenhagen, *A. albiflora* is said to have been introduced in 1812, doubtless to this garden. The species had already been cultivated for some years in other European gardens under the name *A. alba*. Two specimens of *A. albiflora* which were almost certainly available to Hornemann when he described the species are preserved at the Botanical Museum of the University of Copenhagen. One of these specimens is from Hornemann's herbarium; the label is in his handwriting and bears the name *Argemone albiflora* Hornem. For these reasons I am designating this specimen the lectotype of the species. Unfortunately, the label bears no date or place of cultivation. The other specimen referred to is from the herbarium of Schumacker, is identified in the handwriting of Schumacker

as *Argemone albiflora,* bears the symbol denoting the Copenhagen Garden (Hortus Hafniensis) and the date 1814. There can be no reasonable doubt of the authenticity of these two specimens. The plants themselves are excellently preserved and can be identified without question as the species native to coastal southeastern United States.

A. albiflora has not been separated into two subspecies by any previous author, but the morphological differences between the two regional phases seem of sufficient value to require this treatment. On the other hand, there is little doubt that the two taxa should be included in the same species on the basis of what appears to be complete or nearly complete interfertility. Controlled experimental crosses made by myself indicate the presence of no important sterility barriers between the two.

In addition to the key differences between the two subspecies of *A. albiflora,* they also differ in the ordinarily more deeply cut basal leaves of subsp. *texana* and in the generally more prickly stems of subsp. *texana.* The sepal horns of subsp. *albiflora* are ordinarily shorter and broader, and the over-all prickliness of the buds somewhat less. No prickles have been detected on the upper surfaces of the leaves in subsp. *albiflora,* but they are fairly common in subsp. *texana,* though in the latter case only a very few are present.

Key to the subspecies:

1. Capsules oblong to oblong-elliptic, the spines stout, even-sized and widely spaced; coastal areas, N. Carolina to Florida and Mississippi; introduced northward ..... 23a. *A. albiflora* subsp. *albiflora*

1. Capsules usually narrowly elliptical, the widely spaced large spines interspersed with uneven-sized smaller spines and prickles; eastern Texas; introduced to the northeast ..... 23b. *A. albiflora* subsp. *texana.*

23a. ARGEMONE ALBIFLORA Hornem. subsp. ALBIFLORA

A. albiflora Hornem., Hort. Hafn., p. 489. 1815; Sims, in Curtis's Bot. Mag. 49: t. 2342. 1822; Loud., Hort. Brit., p. 216. 1830; Otto & Dietr., in Allgem. Gartenzeit. 1: 300. 1833.

A. mexicana var β Lamarck, Encycl. Méth. 1: 247. 1783; not *A. mexicana* L.

A. alba Lestib., Bot. Belg., ed. 2, pt. 3, 2: 132. 1799, nomen nudum; Raf., Fl. Ludov., p. 83. 1817; Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, as to south coast distribution; Britton & Brown, Ill. Fl. 2: 101. 1897, as to Florida distribution only; Britton, Man., p. 439. 1901, excluding Texas distribution; Mohr, Pl. Alab., in Contr. U. S. Nat. Herb. 6: 520. 1901, as to South Atlantic States only; Small, Fl. s.e. U. S., p. 462. 1903, in part; Robins. & Fern., Gray's Man., ed. 7, p. 416. 1908; Fedde, in Pflanzenr. 4 (104): 279, 274, fig. 36F, G. 1909, excluding Texas specimens; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, in part; Small, Fl. Flor. Keys, p. 52. 1913; Small, Man. s.e. Fl., p. 548. 1933, in part; Steyerm., Sp. Fl. Mo., p. 214. 1940, in part; Fernald, Gray's Man., ed. 8, p. 681. 1950; Gleason, New Ill. Fl. 2: 199. 1952, in part; Jones & Fuller, Vasc. Pl. Ill., p. 221. 1955; not *A. alba* James.

A. mexicana Pursh, Fl. Am. Sept. 2: 366. 1814, as to white-flowered variety; Elliott, Bot. Carol. & Georg. 2: 13. 1824, as to white-flowered variety; Beck, Botany, p. 21. 1833, in part; Gray, Man., ed. 1, p. 26. 1848, excluding yellow-flowered component;

Chapm., Fl. So. U. S., p. 21. 1860, as to white-flowered plants; Chapm., Fl. So. U. S., ed. 3, p. 20. 1897, as to white-flowered plants; not *A. mexicana* L.

Argemone, species with white flowers, Nutt., Gen. 2: 9. 1818.

A. mexicana β *albiflora* DC., Reg. Veg. Syst. Nat. 2: 86. 1821, as to Georgia and Louisiana distribution; DC., Prodr. 1: 120. 1824; Lindl., in Bot. Reg. 16: t. 1343. 1830, in synonymy; not *A. mexicana* L.

A. georgiana Croom, in Am. Journ. Sci. 25: 75. 1834.

A. mexicana var. γ Torr. & Gray, Fl. N. Am. 1: 61. 1838; Walp., Rep. 1: 109. 1842; not *A. mexicana* L.

A. vulgaris γ Spach, Hist. Nat. Vég. 7: 26. 1839.

A. alba var. *typica* Prain, in Journ. Bot. 33: 329. 1895, excluding Texas collection.

A. mexicana var. *alba* Chapm. ex Prain, l.c., p. 329. 1895, nomen nudum in synonomy; not *A. mexicana* L.

A. mexicana var. α Lamarck ex Prain, l.c., p. 329. 1895, in synonomy; not *A. mexicana* L.

A. intermedia Robins. & Fern., Gray's Man., ed. 7, p. 416. 1908, as to Illinois specimens; Fernald, Gray's Man., ed. 8, p. 681. 1950, as to Illinois and Missouri specimens, in part; Jones & Fuller, Vasc. Pl. Ill., p. 221. 1955; not *A. intermedia* Sweet.

Stems sparsely prickly with usually slender prickles; basal and lower cauline leaves lobed to about one-half to two-thirds the distance to the midrib, the middle and upper ones less deeply to shallowly lobed, the uppermost broadly ovate, the upper surfaces of the leaves totally smooth; buds subspherical, sparingly prickly with slender, spreading prickles, the sepal horns 3-5 mm. long, smooth; flowers often separated by an interval of 2-5 mm. from the nearest foliar bract, the interval often increasing to 1-several cm. during development of the fruit; petals white; stamens usually shorter than the pistil at anthesis; stigma 3-4 mm. broad, 2-3 mm. high; capsules 4-5 (3-7) -carpellate, typically oblong to oblong-elliptic, the width, exclusive of spines, 12-15 (-25) mm., the length, including the stigma, 20-40 (-45) mm., armed with widely spaced, stout, spreading, basally herbaceous, simple, mostly even-sized spines and occasionally with a very few smaller spines, the largest spines 6-8 (-10) mm. long, the capsular surface clearly visible; seeds about 2 mm. long. (Ill.: Fig. 24, 1-3; Dist.: Fig. 25.)

Lectotype: That of the species.

Habitat and distribution: In waste places, vacant lots, roadsides, beaches, dunes, in sandy soil. Possibly native only to northern Florida but now established along the coast from southeastern North Carolina across Florida to Mississippi. All records from northward and westward, e.g., Connecticut, Illinois, and Missouri, represent escapes from cultivation.

Flowering and fruiting dates: In Florida and adjacent coastal areas flowering begins in late March and continues through the summer as local conditions permit; first fruits are matured about May 1. When introduced farther north, flowering and fruiting dates are somewhat delayed.

A. albiflora subsp. *albiflora* is best distinguished on the basis of the usually oblong, 4-7-carpellate, stoutly but distantly spinescent capsules. Important supplementary characters are found in the sparsely prickly stems, the smooth upper surfaces of the leaves, the clasping upper leaves, the subspherical buds with short sepal horns and the stamens which are shorter than the ovary at anthesis. Occasionally buds with four sepals and eight petals are seen. Supernumerary sepals and petals are not rare

in *Argemone* and I do not ascribe any taxonomic importance to their occasional occurrence in *A. albiflora*. The tendency to develop a wide interval between the flower or capsule and the first foliar bract in *A. albiflora* has been stressed by previous authors. Again, I do not find this feature to be of particular taxonomic importance although undeniably true.

The natural distribution of *A. albiflora* subsp. *albiflora* is difficult to circumscribe due to the readiness by which it becomes established in unstable habitats in the south. It is a weed in every sense of the word on vacant lots and along roadways in coastal areas of the southeast. Having collected it at several stations in the southeast, the present writer has never seen it growing in indisputably natural circumstances, i.e. as an obvious component of a naturally occurring plant community. In my opinion this taxon represents a relict northern Florida subspecies which during rather recent times has spread along the coast both northward and westward as a ruderal weed. Probably it is not native to the Florida Keys.

The name taken up for this subspecies by Prain was *A. alba* Lestib., the oldest published binomial for the taxon. He points out that, at the time Lestiboudois wrote, this was the only white-flowered *Argemone* known in Europe and that other white-flowered species were not introduced until 1827. *A. alba* Lestib. is, however, a nomen nudum and in accordance with the International Rules the name must be abandoned in favor of the first validly published binomial. The history of the origin of the name *A. alba* as narrated by Prain is of much interest.

Since *A. alba* Lestib. is a nomen nudum it has no taxonomic standing under the Rules and the epithet *alba* is available for this or any other species of *Argemone*. The epithet was, however, next applied to what is almost certainly the same taxon, *A. alba* Rafinesque, and was validly published by him. The valid publication of *A. alba* Raf. is, however, antedated by valid publication of *A. albiflora* Hornem. for the same taxon. *A. alba* James, published in 1823, is a synonym of *A. polyanthemos* (Fedde) Ownbey, and a later homonym of *A. albiflora* Hornem.

As understood by Prain, *A. alba* (i.e., *A albiflora*) consisted of two varieties, var. *typica* and var. *glauca*. My two subspecies of *A. albiflora* are equivalent to Prain's var. *typica*. Subsp. *albiflora* includes the classical material of this taxon. Prain's var. *glauca* (i.e., *A. glauca* Nutt., MSS), endemic to the Hawaiian Islands, is a distinct species whose closest affinities certainly do not lie with any North American species of *Argemone*.

I have seen no specimens purported to be *A. alba* Raf. The description could certainly appertain to *A. albiflora* Hornem. If this is true, then its introduction into Louisiana could not have been from Mexico as is stated by Rafinesque. Probably it came from Florida. In reaching this conclusion, I differ from Prain (1895, p. 330), who does not question the

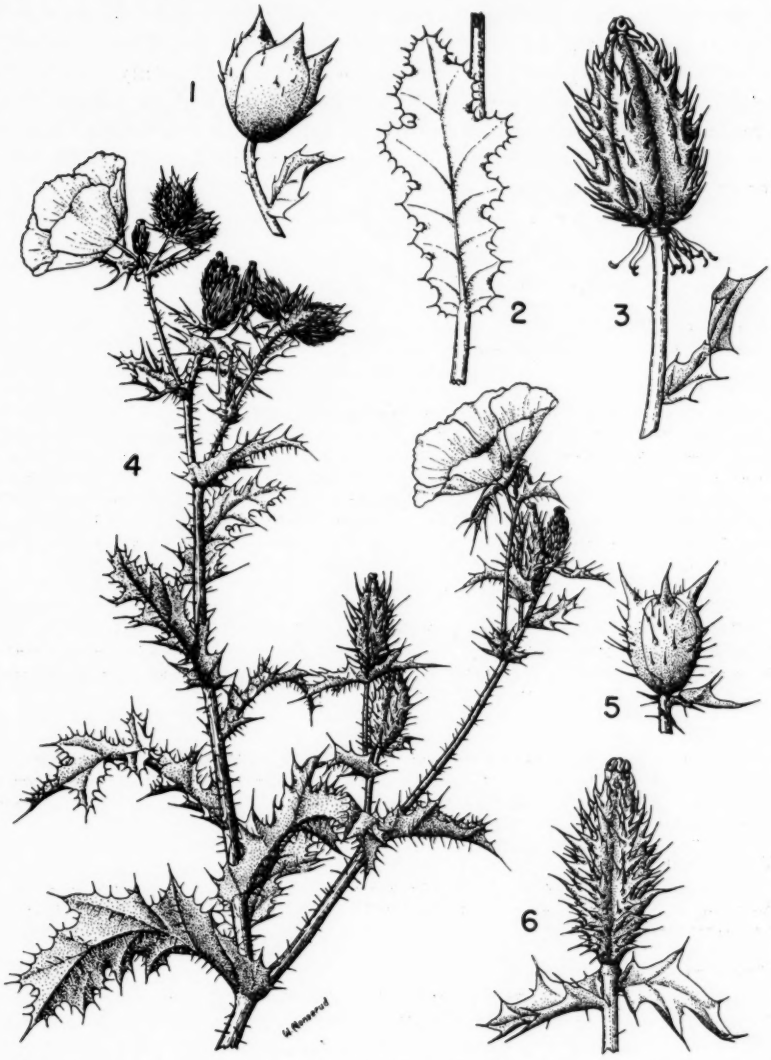

FIG. 24. 1-3. *A. albiflora* subsp. *albiflora*. 1. Bud × 1. Cult. from seeds of *Ownbey & Ownbey* 1350 (MIN). 2. Middle cauline leaf, under surface × ½. Cult. from seeds of *Ownbey & Ownbey* 1375 (MIN). 3. Capsule × 1. Same as 1. 4-6. *A. albiflora* subsp. *texana*. 4. Habit × ½. Holotype, *Ownbey & Ownbey* 1388 (MIN). 5. Bud × 1. Cult. from seeds of *Ownbey & Ownbey* 1387 (MIN). 6. Capsule × 1. Same as 5.

accuracy of Rafinesque's statement as to the origin of the Louisiana plants. Rafinesque's description reads: "Caule foliisque spinosis, foliis runcinatis, capsulis oblongis pentagonis spinosis semi-5-valvis." Only one white-flowered Mexican species of *Argemone* has capsules of this description. This is *A. grandiflora* which, except for the newly described subsp. *armata*, has essentially unarmed stems and must be eliminated from consideration for this and other reasons.

Specimens examined: UNITED STATES.

ALABAMA

Macon Co.: Tuskegee, *Andrews s.n.* (NY, US).

CONNECTICUT

Fairfield Co.: Fairfield, *Eames* 11901a (US).

FLORIDA

Bay Co.: Panama City, *Ownbey & Ownbey* 1377 (MICH, MIN). Columbia Co.: Lake City, *Rolfs* 101 (GH, MIN, RM). Duval Co.: Pilot Island, mouth of St. John's River, *Small & DeWinkeler* 9838 (NY, US). Franklin Co.: Carrabelle, *Ownbey & Ownbey* 1375 (DUKE, GA, GH, MIN, NCU, TEX, US). Lake Co.: Eustis, *Nash* 656 (F, GH, MIN, MO, ND, NY, UC, US). Monroe Co.: Key West, *Blodgett s.n.* (NY); Indian Key, *Blodgett s.n.* (NY). Leon Co.: near Tallahassee, *Berg s.n.* (NY). Pinellas Co.: Palm Harbor, *Moldenke* 1059 (MO, NY). Putnam Co.: Palatka, *ex herb. Hood s.n.* (MO).

GEORGIA

Chatham Co.: Savanna, *Ownbey & Ownbey* 1350 (C, CAS, F, GA, GH, K, KSC, MIN, NY, RM, SMU, TEX, UC, US). McIntosh Co.: .5 miles s. of Darien, *Ownbey & Ownbey* 1352 (DUKE, GA, MIN, NCU, SMU). Glynn Co.: Ocean Pier, St. Simon's Island, *Harper* 1530 (GH, MO, NY, US).

ILLINOIS

Henderson Co.: Oquawka, *Patterson s.n.* (F, MO). Madison Co.: Pope Station, *Eggert s.n.* (MIN, MO, UC). Morgan Co.: banks of Illinois River, Meredosia, *Seymour s.n.* (GH). Peoria Co.: Peoria, *McDonald s.n.* (GH). Stephenson Co.: Freeport, *Johnson s.n.* (US).

MISSISSIPPI

Hancock Co.: Bay of St. Louis, *Cook s.n.* (US). Harrison Co.: 4.5 miles e. of Gulfport, *Ownbey & Ownbey* 1379 (GA, MIN, NCU, SMU); Biloxi, *Tracy* 6894 (F, GH, MIN, MO, NY, US).

MISSOURI

Dunklin Co.: Campbell, *Bush* 3 (MO, NY). Howell Co.: Carson, *Eggert s.n.* (MO). Jackson Co.: Sheffield, *Bush* 9480 (F, MO). St. Louis Co.: Allenton, *Letterman s.n.* (MO).

NORTH CAROLINA

Brunswick Co.: Southport, *Godfrey & Wiebe* 50378 (GH, SMU).

SOUTH CAROLINA

Beaufort Co.: Beaufort, *Churchill s.n.* (CAS, GH, MO). Charleston Co.: Sullivans Island, *Palmer s.n.* (US). Jasper Co.: no locality, *Meyers s.n.* (NY).

23b. ARGEMONE ALBIFLORA Hornem. subsp. **texana** G. B. Ownb., subsp. nov.

A. alba Gray, Syn. Fl. N. Am. 1 (1): 88. 1895, as to Texas distribution, in part; Britton, Man., p. 439. 1901, as to Texas distribution; Small, Fl. s.e. U. S., p. 462. 1903, in part; Fedde, in Pflanzenr. 4 (104): 279. 1909, as to *Rose* 4893 cited; Britton & Brown, Ill. Fl., ed. 2, 2: 139. 1913, in part; Small, Man. s.e. Fl., p. 548. 1933, in part; Steyerm., Sp. Fl. Mo., p. 214, Pl. 57, fig. 3. 1940, in part; Gleason, New Ill. Fl. 2: 199. 1952, in part; not *A. alba* Lestib.

A. intermedia Fedde, in Pflanzenr. 4 (104): 281. 1909, in small part; Fernald, Gray's Man., ed. 8, p. 681. 1950, as to Missouri specimens, in part; not *A. intermedia* Sweet.

A. platyceras Fedde, in Pflanzenr. 4 (104): 283. 1909, in small part; not *A. platyceras* L. & O.

Herba annua aut biennis latice flavo. Caules 4-10 (-15) dm. alti, sparse vel moderate aculeati. Folia inferiora saepe pinnatifida lobis oblongis, superiora levitius lobata, terminalia caulem ad basem latam amplectentia. Lamina subter in venis principalibus sparse aculeata, supra omnino inermia aut subinermia. Alabastra late elliptica vel subsphaerica. Sepalorum cornua subteretia, 4-6 (-10) mm. longa. Flores 5-10 cm. diametro, petalis albis, staminibus circa 150 vel plus. Capsulae 4-5 (3-5) -carpellatae, anguste ellipticae, 10-14 mm. latae, 25-35 (-40) mm. longae, moderate spinescentes aut spinis plerumque tenuibus patentibus basaliter herbaceis simplicibus aut multis et inaequalibus et parvioribus spinis et quoque aculeis. Semina circa 1.7 mm. longa.

Stems sparsely to rather moderately prickly with usually slender, perpendicular or recurved prickles; basal and lower cauline leaves often lobed to near the midrib, the middle and upper ones more shallowly lobed, the upper surfaces of the leaves either totally smooth or with a very few weak prickles mainly on the midrib; buds broadly elliptical to subspherical, sparingly to rather closely prickly with slender, spreading, simple prickles, the sepal horns 4-6 (-10) mm. long, smooth or sparingly prickly at the base; flowers usually rather closely subtended by 1-2 foliar bracts, the interval between flower and nearest bract sometimes to about 5 mm. at fruiting time; petals white (or rarely lavender ?); stamens equal to or shorter than the pistil at anthesis; stigma 2.0-3.5 mm. broad, 1.5-2.0 mm. high; style sometimes evident; capsules 4-5 (3-) -carpellate, typically narrowly elliptical, the width, exclusive of spines, 10-14 mm., the length, including the stigma, 25-35 (-40) mm., moderately armed with usually slender, spreading, basally herbaceous, simple spines as well as numerous uneven-sized smaller spines and prickles, the largest spines 7-10 (-12) mm. long, the capsular surface partially obscured; seeds about 1.7 mm. long. (Ill.: Fig. 24, 4-6; Dist.: Fig. 25.)

Holotype: *Gerald B. Ownbey & Findley Ownbey* 1388, from 4.3 miles w. of Brenham, Washington Co., Texas, July 11, 1950 (MIN; isotypes, GH, MIN, NY, SMU, UC, US).

Habitat and distribution Sandy or gravelly soils, embankments, vacant lots, pastures, waste ground, roadsides, fence rows, railroad rights-of-way, abandoned fields, flat terrain or rolling hills, now usually a weed; probably originally of rather restricted range in eastern Texas, but now spread to northeastern Texas, northern Arkansas and southern Missouri.

Flowering and fruiting dates: Earliest flowers are produced about March 15 and flowering continues through spring, summer and fall if local conditions permit; first fruits may mature during the fourth week in April but fruits mature most abundantly during May and June; late fruits mature until October.

This subspecies is most readily distinguished by the narrowly elliptical capsules armed with larger spines intermingled with smaller, uneven-sized spines and prickles. Important supplementary characters are the deeply pinnatifid basal and lower cauline leaves, the clasping upper cauline leaves, the usually entirely smooth upper surfaces of the leaves, and the stamens which are often shorter than the pistil at anthesis.

The first specimens of this subspecies apparently were collected by Drummond in 1835. It has since been collected by many botanists, usually as single specimens. I have, however, thought it best to designate one of my own specimens as the holotype because of the opportunity thus afforded to distribute isotype material to a large number of institutions.

In southern Texas where the distributions of *A. albiflora* subsp. *texana* and *A. sanguinea* impinge upon each other, separation of immature material of the two is sometimes difficult. In most cases, the larger buds, flowers and stigmas of the latter species as well as the usually longer sepal horns serve to distinguish it, but all of these characters break down at times. The foliage of both taxa is highly variable and no constant differences have been found. Also, the petals in *A. sanguinea* although often lavender are sometimes white as in *A. albiflora*. Good differences between the two, however, do reside in the mature fruits in most instances.

There is unlimited opportunity for natural hybridization between *A. albiflora* subsp. *texana* and *A. sanguinea*. As far as is known, however, the former is always diploid and the latter always tetraploid in the distributional area common to both. If hybridization actually takes place it is doubtful if it proceeds beyond the first generation. The occurrence of even occasional hybrid plants would, nevertheless, account for some of the difficulties sometimes met with in distinguishing the two described above.

A. albiflora subsp. *texana* is thought to hybridize readily with *A. polyanthemos* in nature. A fuller discussion of this subject is presented under the latter species. The assumption is borne out by controlled crosses between cultivated plants of the two taxa which indicate that they may be crossed without great difficulty. A close genetic relationship is unquestionably present. The two taxa are sufficiently distinct on morphological and distributional grounds, however, to justify their recognition as separate species.

Specimens examined: UNITED STATES.

ARKANSAS

Clay Co.: Corning, *Eggert s.n.* (MO). Izard Co.: Guion, *Emig* 42 (MO). Marion Co.: Yellville, *Moore* 32662 (TEX). Stone Co.: Onia, alt. 750 ft., *Demaree* 27870 (RM).

MISSOURI

Butler Co.: Poplar Bluff, *Dewart s.n.* (MO); Neelyville, *Kellogg* 15186 (MO).

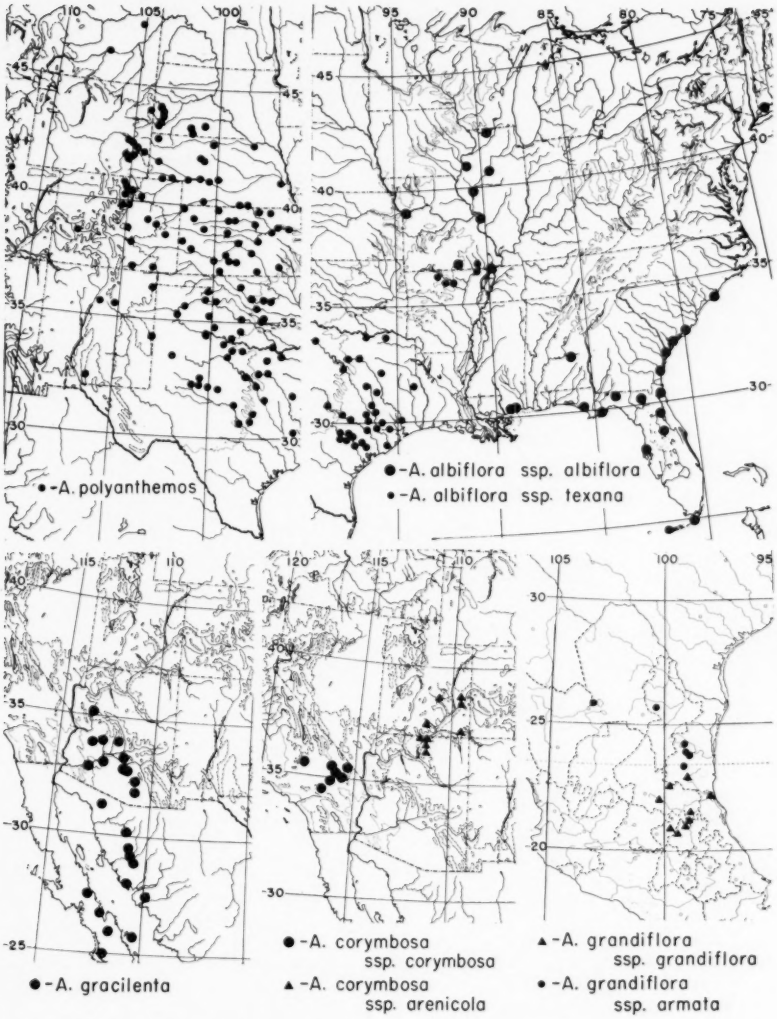

FIG. 25. Geographical distributions of species and subspecies as indicated.

TEXAS

Austin Co.: San Felipe, *Lindheimer s.n.* (MO); 8 miles e. of Sealy, *Cory* 55067 (SMU, US). Bastrop Co.: 7.9 miles w. of Bastrop, *Ownbey & Ownbey* 1393 (MIN, NCU, NY, SMU). Baylor Co.: w. of Seymour, *Shinners* 18596 (SMU). Brazoria Co.: Brazoria, *Palmer* 5123 (MO, POM, US). Brazos Co.: College Station, *Pammel s.n.* (MO). Burleson Co.: 2 miles s. of Somerville, *Shinners* 14683 (SMU). Caldwell Co.: no locality, *McBryce s.n.* (TEX). Colorado Co.: ¾ mile n.w. of Columbus, *Cory* 54272 (SMU). Dallas Co.: n.w. of Carrollton, .5 mile s.e. of Denton Co. line, *Shinners* 8509 (GH, SMU); no locality, *Reverchon s.n.* (MO). DeWitt Co.: Cuero, *Marlatt s.n.* (US). Fayette Co.: Schulenburg, *Ownbey & Ownbey* 1650 (C, CAS, F, GH, K, KSC, MICH, MIN, NCU, NY, RM, TEX, UC, US). Fort Bend Co.: 1.4 miles n.e. of Richmond bridge, *Ownbey & Ownbey* 1589 (MIN). Gonzales Co.: s.e. of Gonzales, *Whitehouse* 11806 (SMU). Grayson Co.: Denison, *Gentry* 303 (TEX). Guadalupe Co.: 3 miles s. of Seguin, *Cory* 54060 (SMU). Harris Co.: Houston, *Fisher* 306 (RM, US). Henderson Co.: Athens, *Shinners* 15115 (SMU). Jackson Co.: Horseshoe Lake, *Drushel* 6493 (MO). Lamar Co.: Paris, *McMullen s.n.* (TEX). Lavaca Co.: about 18 miles s.e. of Yoakum, *Tharp, Rogers & York* 49169 (TEX). Leon Co.: Normangee State Park, *Whitehouse* 11801 (SMU). Liberty Co.: near Liberty, *Rose* 4893 (US). Llano Co.: near Enchanted Rock, *Innes & Warnock* 786 (GH, TEX). Limestone Co.: 7.6 miles s.-s.w. of Mexia, *Shinners* 14549 (MIN, SMU). San Augustine Co.: San Augustine, *Crocket s.n.* (US). Somervell Co.: 4 miles n.e. of Glen Rose, *Wagner* 61 (SMU). Tarrant Co.: along T. & P. R.R., *Ruth s.n.* (F). Travis Co.: Austin, *Tharp s.n.* (GH, MO, UC). Waller Co.: 4.3 miles e. of Hempstead, *Ownbey & Ownbey* 1387 (DUKE, GA, MIN, TEX). Washington Co.: 4.3 miles w. of Brenham, *Ownbey & Ownbey* 1388 (MIN, holotype of *A. albiflora* subsp. *texana* Ownb.; isotypes, GH, MIN, NY, SMU, UC, US). Wilson Co.: Stockdale, *Cory* 54071 (SMU). County uncertain: no locality, *Drummond* 8 (GH); vicinity of Brazos, *Lindheimer s.n.* (MO).

Excluded Names

Argemone armeniaca L., Sp. Pl. 1: 509. 1753; Willd., Sp. Pl. 2: 1149. 1799; is *Papaver* sp.

Argemone cambrica (L.) Desportes, in Dict. Sci. Nat. 2: 481. 1804, is *Meconopsis cambrica* (L.) Vig.

Argemone intermedia Sweet, Hort. Brit., ed. 2, p. 585. 1830; Sweet, Hort. Brit., ed. 3, p. 22. 1839, of uncertain application. See discussion under *A. polyanthemos*.

Argemone pyrenaica L., Sp. Pl. 1: 509. 1753; Willd., Sp. Pl. 2: 1149. 1799; is *Papaver* sp.

Literature Cited

Abrams, L. R. 1904. Flora of Los Angeles and vicinity.

———. 1944. Illustrated flora of the Pacific States. Vol. 2.

Aiton, W. 1789. Hortus kewensis. Vol. 2.

———. 1811. Hortus kewensis. Second ed. enlarged, by W. T. Aiton. Vol. 3.

Otto & Dietrich. 1883. Cultur und beschreibung der *Argemone Hunnemanni*. Allgemeine Gartenzeitung 1: 298-300.

Baillon, H. 1871. Historie des plantes. Vol. 3.

Baker, J. G. 1877. Flora of Mauritius and the Seychelles.

Balfour, I. B. 1888. Botany of Socotra. Trans. of the Royal Soc. Edinburgh. Vol. 31.

Bauhin, C. 1596. Phytopinax.

———. 1623. Pinax.

Beck, L. C. 1833. Botany of the northern and middle states.

Bentham, G. & J. D. Hooker. 1862. *Argemone*. Genera plantarum. Vol. 1.

Bernhardi, J. J. 1833. Über den charakter und verwandtschaft der Papaveraceen und Fumariaceen. Linnaea **8**: 401-477, t. x, figs. 1-29.
Blanco, M. 1837. Flora de Filipinas.
———. 1878. Flora de Filipinas. Gran ed. Vol. 2.
Boldingh, I. 1913. Flora voor de Nederlandsch West-Indische Eilanden.
Bowerman, M. L. 1944. The flowering plants and ferns of Mount Diablo, California.
Brewer, W. H. & S. Watson. 1880. Polypetalae, in J. D. Whitney, Geol. surv. California: Botany. Ed. 2, vol. 1.
Britton, N. L. 1901. Man. of the flora of the northern states and Canada.
———. 1918. Flora of Bermuda.
———, **& A. Brown.** 1897. An illustrated flora of the northern United States, Canada and the British possessions. Vol. 2; Ed. 2. 1913. Vol. 2.
———, **& C. F. Millspaugh.** 1920. The Bahama flora.
———, **& H. H. Rusby.** 1887. A list of plants collected by Miss Mary B. Croft, 1884-'85, at San Diego, Texas. Trans. New York Acad. Sci. **7**: 7-14.
Candolle, A. P. de. 1821. Regni vegetabilis systema naturale. Vol. 2.
———. 1824. Prodromus systematis naturalis regni vegetabilis. Vol. 1.
Chapman, A. W. 1860. Flora of the southern United States; Ed. 3. 1897.
Clokey, I. W. 1951. Flora of the Charleston Mountains, Clark County, Nevada. Univ. Calif. Pub., Botany. Vol. **24**.
Cockerell, W. P. 1917. Collecting bees in southern Texas. Journ. New York Entomol. Soc. **25**: 192.
Conzatti, C. 1903. Los géneros vegetales Mexicanos.
Cook, O. F. & G. N. Collins. 1903. Economic plants of Porto Rico. Contr. U. S. Nat. Herb. **8**: 57-269.
Coulter, J. M. 1873. Botany, in F. V. Hayden, Sixth Annual Rep. of the U. S. Geol. Surv. 1872: 747-792.
———. 1885. Manual of the Botany of the Rocky Mountain Region.
———. 1890. Upon a collection of plants made by Mr. G. C. Nealley, in the region of the Rio Grande. Contr. U. S. Nat. Herb. **1**: 29-65.
———. 1891. Botany of western Texas. Contr. U. S. Nat. Herb. **2**: 1-588.
———, **& A. Nelson.** 1909. New manual of Botany of the central Rocky Mountains.
Coville, F. V. 1893. Botany of the Death Valley expedition. Contr. U. S. Nat. Herb. **4**: 1-318.
Croom, H. B. 1834. Botanical communications. Am. Journ. Sci. & Arts **25**: 69-78.
Curtis, W. 1794. Bot. Mag. **7**: t. 243.
Darlington, W. 1826. Florula Cestrica. Ed. 3. 1853.
Davidson, A. & G. L. Moxley. 1923. Flora of southern California.
Durand, E. 1860. A sketch of the botany of the basin of the Great Salt Lake of Utah. Trans. Am. Philosoph. Soc. **11**: 155-180.
———, **& T. C. Hilgard.** 1854. Plantae Heermannianae. Journ. Acad. Nat. Sci. Phila., second series **3**: 37-46.
———, **&** ———. 1855. Botanical report, in R. S. Williamson, Report, Pacific railroads, expl. & surv. **5** (3): 5-15.
Eastwood, A. 1896. On Dr. D. Prain's account of the genus *Argemone*. Erythea **4**: 93-96.
Eaton, A. 1817. Manual of Botany for North America; Ed. 7, 1836.
Elliott, S. 1824. Sketch of the Botany of South Carolina and Georgia. Vol. 2.
Endlicher, S. 1836-1840. Genera plantarum secundum ordines naturales disposita.
Fawcett, W. & A. B. Rendle. 1914. Flora of Jamaica. Vol. 3.
Fedde, F. 1905. Die geographische Verbreitung der Papaveraceae. Botanischen Jahrb. **36** (Beibl. 81): 28-43.
———. 1909. *Argemone*, in A. Engler, Das Pflanzenr. **4** (104): 271-287.
Fernald, M. L. 1950. Gray's manual of botany. Ed. 8.
Fernandez-Villar, C. 1880. Novissima appendix ad floram Philippinarum R. P. Fr. Emmanuëlis Blanco.

Fitzherbert, S. W. 1907. *Argemone grandiflora.* The Gardener's Chronicle, series 3, **42**: 113.
Gaertner, J. 1788. De fructibus et seminibus plantarum. Vol. 1.
Garrett, A. O. 1936. Spring flora of the Wasatch region. Ed. 5.
Gates, F. C. 1940. Flora of Kansas.
Gentry, H. S. 1942. Río Mayo plants. Carnegie Inst. Wash. Pub. 527.
Gerard, J. 1597. The herball or generall historie of plantes.
Gleason, H. A. 1952. The new Britton & Brown Illustrated Flora. Vol. 2.
Gray, A. 1848. A manual of the botany of the northern United States.
———. 1849. The genera of the plants of the United States.
———. 1849. Plantae Fendlerianae Novi-Mexicanae. Mem. Am. Acad. Arts & Sci., n. s. **4**: 1-116.
———. 1853. Plantae novae Thurberianae. Mem. Am. Acad. Arts & Sci., n. s. **5**: 297-328.
———. 1860. Catalogue of plants collected east of the Rocky Mountains, in I. I. Stevens, Report, Pacific railroads, expl. & expl. & surv. **12** (2): 40-49.
———. 1895. Synoptical flora of North America **1** (1): 87-88.
Greene, E. L. 1886. Studies in the botany of California and parts adjacent. Bull. Calif. Acad. Sci. **2**: 41-60.
———. 1898. New or noteworthy species.—XXIII. Pittonia **3**: 343-349.
———. 1899. New or noteworthy species.—XXIV. Pittonia **4**: 68-72.
———. 1892. Flora Franciscana.
———. 1908. *Argemone pleiacantha* Greene, in F. Fedde, Rep. Sp. Nov. **6**: 161.
Grisebach, A. H. R. 1864. Flora of the British West Indian Islands.
Hall, H. M. 1902. A botanical survey of San Jacinto Mountain. Univ. Calif. Pub., Botany **1**: 1-140.
Harrington, H. D. 1954. Manual of the plants of Colorado.
Harshberger, J. W. 1898. Botanical observations on the Mexican flora. Proc. Acad. Nat. Sci. Phila. 1898: 372-413.
Hemsley, W. B. 1879. Biologia Centrali-Americana. Botany **1**: 26-27; Vol. **4**: 4, 97, 111. 1886-1887.
Hitchcock, A. S. 1896. Report on a collection of plants made by C. H. Thompson in southwestern Kansas, in 1893. Contr. U. S. Nat. Herb. **3**: 537-557.
Hooker, J. D. 1872. Flora of British India. Vol. **1**, pt. 1.
———. 1878. *Argemone hispida*, in W. Curtis, Bot. Mag. **104**: t. 6402.
———, **& T. Thomson.** 1855. Flora Indica. Vol. **1**.
Hooker, W. J. 1831. *Argemone grandiflora*, in W. Curtis, Bot. Mag. **58**: t. 3073.
———. 1834. Notice concerning Mr. Drummond's collections. Journ. Bot. **1**: 183-202.
Hornemann, J. W. 1815. Hortus regius botanicus hafniensis, in usum tyronum et botaniphilorum.
Jackson, B. D. 1907. On a manuscript list of the Linnaean herbarium. Proc. Linn. Soc. London 1906-1907: 89-126.
———. 1912. Index to the Linnean herbarium with indication of the types of species marked by Carl von Linné. Proc. Linn. Soc. London 1911-1912: Suppl. 1-152.
James, E. 1823. Account of an expedition from Pittsburgh to the Rocky Mountains, 1819-1820.
———. 1825. Catalogue of plants collected during a journey to and from the Rocky Mountains, during the summer of 1820. Trans. Am. Philosoph. Soc., n. s. **2**: 172-190.
Jepson, W. L. 1922. A flora of California. Vol. 1, pt. 7.
———. 1925. A manual of the flowering plants of California, pp. 399-400.
Johnston, I. M. 1924. Expedition of the California Academy of Sciences to the Gulf of California in 1921, the botany. Proc. Calif. Acad. Sci. **12**: 951-1218.
Jones, G. N. & G. D. Fuller. 1955. Vascular plants of Illinois.
Jussieu, A. L. 1789. Genera plantarum secundum ordines naturales disposita.

Kearney, T. H. & R. H. Peebles. 1942. Flowering plants and ferns of Arizona.
———, & ———. 1951. Arizona flora.
Kuntze, O. 1891. Revisio generum plantarum.
Lamarck. 1783. Encyclopédie méthodique. Vol. 1.
———. 1797. Planches 2: t. 452.
Lanjouw, J. & F. A. Stafleu. 1954. Index Herbariorum, ed. 2. Regnum Vegetabile 2: 1-179.
Lestiboudois, F. J. 1799. Botanographie Belgique. Ed. 2, pt. 3, second volume.
Lindley, J. 1829. *Argemone grandiflora*, in S. Edwards, Bot. Reg. 15: t. 1264.
———. 1830. *Argemone mexicana* var. *ochroleuca*, in S. Edwards, Bot. Reg. 16: t. 1343.
Link, H. F. & F. Otto. 1830 (1831?). Icones plantarum rariorum horti regii botanici Berolinensis. Part 1: 85-86, t. 43.
Linnaeus, C. 1753. Species plantarum.
———. 1754. Genera plantarum. Ed. 5.
———. 1759. Systema naturae. Ed. 10.
Loddiges, C. 1829. The botanical cabinet 16: t. 1546.
Loudon, J. C. 1830. *Argemone grandiflora; A. barclayana.* The Gardener's Magazine. Vol. 6.
———. 1830. Hortus brittanicus; First add. suppl., 1832; Ed. 2. 1832.
Loureiro, J. de. 1790. Flora Cochinchinensis. Vol. 1.
Lunan, J. 1814. Hortus Jamaicensis. Vol. 2.
Martínez, M. 1937. Catalogo de nombres vulgares y científicos de plantas mexicanas.
McDougall, W. B. & O. E. Sperry. 1951. Plants of Big Bend National Park.
Meisner, C. F. 1836-1843. Plantarum vascularium genera secundum ordines naturales digesta.
Metcalfe, C. R. & L. Chalk. 1950. Anatomy of the Dicotyledons.
Miller, P. 1759. The Gardeners Dictionary. Ed. 7.
———. 1759. Figures of the most beautiful, useful, and uncommon plants. Vol. 1.
Moench, C. 1794. Methodus plantas horti botanici et agri Marburgensis, a staminum situ describendi.
Mohr, C. 1901. Plant life of Alabama. Contr. U. S. Nat. Herb. Vol. 6.
Moscoso, R. M. 1943. Catalogus florae Domingensis.
Mueller, C. 1857. *Argemone*, in Walpers, Annales botanices systematicae. Vol. 4; Vol. 7, 1868.
Munz, P. A. 1935. A manual of southern California botany.
Murbeck, Sv. 1912. Untersuchungen über den Blütenbau der Papaveraceen. Kungl. Svenska Vetens. Handl. 50: 1-168, t. 1-28.
Nelson, A. 1902. An analytical key to some of the common flowering plants of the Rocky Mountain region.
———. 1902. Contributions from the Rocky Mountain Herbarium. IV. Bot. Gaz. 34: 355-371.
———. 1912. Spring flora of the Intermountain States.
Nieuwland, J. A. 1914. Notes on our local plants.—IX, Am. Midl. Nat. 3: 346-351.
Norton, J. B. S. 1902. Notes on some plants of the southwestern United States. Trans. Acad. Sci. St. Louis 12: 35-41.
Nuttall, T. 1818. The genera of North American plants. Vol. 2.
Oliver, D. 1868. Flora of tropical Africa. Vol. 1.
Over, W. H. 1932. Flora of South Dakota.
Parish, S. B. 1918. Notes on some southern California plants. Bot. Gaz. 65: 334-343.
Peck, M. E. 1941. A manual of the higher plants of Oregon.
Persoon, C. H. 1807. Synopsis plantarum. Vol. 2.
Petersen, N. F. 1923. Flora of Nebraska. Ed. 3.
Poiret, J. L. M. 1804. Lamarck, Encyclopédie méthodique. Vol. 5.
Porter, T. C. 1871. Catalogue of plants, in F. V. Hayden, Preliminary report of the United States geological survey 1870: 472-483.

———, **& J. M. Coulter.** 1874. Synopsis of the flora of Colorado.
Prain, D. 1895. An account of the genus *Argemone*. Journ. Bot. **33**: 129-135, 176-178, 207-209, 307-312, 325-333, 363-371.
Prantl, K. & J. Kündig. 1889. Papaveraceae, in A. Engler & K. Prantl, Nat. Pflanzenf. **3 (2)**: 130-142.
Pringle, C. G. 1900. Plantae Mexicanae.
Pursh, F. 1814. Flora Americae Septentrionalis.
Rafinesque, C. S. 1817. Florula Ludoviciana.
Rickett, H. W. 1955. Materials for a Dictionary of Botanical Terms—III. Inflorescences. Bull. Torr. Bot. Cl. **82**: 419-445.
Robinson, B. L. & M. L. Fernald. 1908. Gray's new manual of botany. Ed. 7.
Rose, J. N. 1903. The Mexican species of *Argemone*. Contr. U. S. Nat. Herb. **8**: 23-27.
Rothrock, J. T. 1878. Reports upon the botanical collections. Report upon U. S. Geographical Surveys west of the one hundred meridian. Vol. **6** (Botany).
Roxburgh, W. 1832. Flora Indica. Vol. **2.**
Rydberg, P. A. 1895. Flora of the sand hills of Nebraska. Contr. U. S. Nat. Herb. **3**: 133-203.
———. 1896. Flora of the Black Hills of South Dakota. Contr. U. S. Nat. Herb. **3**: 463-536.
———. 1902. Studies on the Rocky Mountain flora—VII. Bull. Torr. Bot. Cl. **29**: 145-160.
———. 1906. Flora of Colorado.
———. 1917. Flora of the Rocky Mountains and adjacent plains.
———. 1932. Flora of the prairies and plains of central North America.
Salisbury, R. A. 1796. Prodromus stirpium in horto ad Chapel Allerton vigentium.
Savage, S. 1945. A catalogue of the Linnnaean herbarium.
Seemann, B. 1852-57. The botany of the voyage of H.M.S. Herald.
Shecut, J. L. E. W. 1806. Flora Carolinaeensis.
Sims, J. 1822. *Argemone albiflora*, in W. Curtis, Bot. Mag. **49**: t. 2342.
Small, J. K. 1903. Flora of the southeastern United States.
———. 1913. Flora of the Florida Keys.
———. 1933. Manual of the southeastern flora.
Smith, J. D. 1898. Polypetalae, in H. Pittier, Primitiae Florae Costaricensis. Vol. **2.**
Spach, É. 1839. Histoire naturelle des végétaux. Vol. **7.**
Sprengel, C. 1825. Systema vegetabilium. Ed. 16, vol. **2.**
Stahl, A. 1936. Estudios sobre la flora de Puerto Rico. Ed. 2.
Standley, P. C. & J. A. Steyermark. 1946. Flora of Guatemala. Fieldiana: Botany **24** (4): 348-349.
Stehlé, H., M. Stehlé & L. Quentin. 1937. Flore de la Guadeloupe et dependances. Vol. **2**, pt. 1.
Stemen, T. R. & W. S. Myers. 1937. Oklahoma flora.
Steudel, E. T. 1840. Nomenclator botanicus. Ed. 2, vol. **1.**
Stevens, W. C. 1948. Kansas wild flowers.
Steyermark, J. A. 1940. Spring flora of Missouri.
Stokes, J. 1812. A botanical materia medica. Vol. **3.**
Sugiura, T. 1936. Studies on the chromosome numbers in higher plants, with special reference to cytokinesis, I. Cytologia **7**: 544-595.
———. 1940. Chromosome studies on Papaveraceae with special reference to the phylogeny. Cytologia **10**: 558-576.
Sweet, R. 1827-29. The British Flower-Garden.
———. 1830. Hortus Brittanicus. Ed. 2; Ed. 3. 1839.
Swift, H. W. 1939. *Argemone platyceras rosea*. Addisonia **20**: 49, t. 665.
Taylor, G. 1934. An account of the genus *Meconopsis*.
Tidestrom, I. 1925. Flora of Utah and Nevada. Contr. U. S. Nat. Herb. **25**: 1-665.
Torrey, J. 1828. Some account of a collection of plants made during a journey to

and from the Rocky Mountains in the summer of 1820, by Edwin P. James. Ann. Lye. Nat. Hist. N. Y. 2: 161-254.

———. 1845. Catalogue of plants collected by Lieut. Fremont, in his expedition to the Rocky Mountains, in J. C. Fremont, Report of the exploring expedition to the Rocky Mountains, pp. 81-101.

———. 1848. Appendix No. 6 to W. H. Emory, Notes of a military reconnaissance from Fort Leavenworth, in Missouri, to San Diego, in California.

———. 1852. Botany, in H. Stansbury, An expedition to the valley of the Great Salt Lake of Utah.

———. 1856. Description of the general botanical collections, in A. W. Whipple, Report, Pacific railroads, expl. & surv. **4** (5): 61-161.

———. 1856. List and description of the plants collected, in J. G. Parke, Report, Pacific railroads, expl. & surv. **7** (3): 7-22.

———. 1857. Descriptions of plants collected along the route, by W. P. Blake, and at the mouth of the Gila, in R. S. Williamson, Report, Pacific railroads, expl. & surv. **5** (2): 359-370.

———, **& A. Gray.** 1838. Flora of North America. Vol. **1.**

Tournefort, J. P. de. 1694. Élémens de botanique.

———. 1700. Institutiones rei herbariae.

———. 1797. Élémens de botanique. Vol. 2 of éd. aug., by N. Jolyclere.

Urban, I. 1905. Symbolae antillanae seu fundamenta florae Indiae Occidentalis. Vol. **4**; Vol. **8.** 1920.

Urbina, M. 1897. Catalogo de plantas Mexicanas.

Vasey, G. & J. N. Rose. 1890. List of plants collected by Dr. Edward Palmer in Lower California and western Mexico in 1890. Contr. U. S. Nat. Herb. **1**: 63-90.

Vilmorin, P. L. de. 1912. *Argemone* hybrides. Revue Horticole **12**: 277-279.

Vitman, F. 1789. Summa plantarum. Vol. **3.**

Walpers, G. G. 1842. Repertorium botanices systematicae. Vol. **1.**

———. 1852. Annales botanices systematicae. Vol. **2.**

Walter, T. 1788. Flora Caroliniana.

Watson, S. 1871. Catalogue of the known plants of Nevada and Utah, in C. King, U. S. Geol. Expl. Fortieth Parallel. Vol. **5.**

———. 1878. Bibliographical index to North American botany.

———. 1882. Contributions to American botany. Proc. Am. Acad. Arts & Sci. **17**: 316-382.

———. 1888. Contributions to American botany. Proc. Am. Acad. **24**: 36-87.

Weber, W. A. 1953. Handbook of plants of the Colorado Front Range.

Wight, R. 1840. Illustrations of Indian botany. Vol. **1.**

———, **& G. A. Walker-Arnott.** 1834. Prodromus florae peninsulae Indiae orientalis. Vol. 1.

Willdenow, C. L. 1799. Species plantarum. Vol. **2.**

Wolf, C. B. 1938. California plant notes II. The California argemones. Rancho Santa Ana Botanic Garden: Occasional papers, ser. **1** (no. 2): 58-63.

Wooton, E. O. & P. C. Standley. 1915. Flora of New Mexico. Contr. U. S. Nat. Herb. **19**: 1-794.

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vulgaris γ 137
Carduus chrysanthemus peruanus 30
Ectrus 21
mexicanus 30
trivialis 30
Enomegra 21
bipinnatifida 65
hispida 65
L'Argemone du Mexique 30
Papaver spinosum 30

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Spruce, Richard. Hepaticae bolivianae, in Andibus Boliviae orientalis, annis 1885-6, a cl. H. H. Rusby lectae. Vol. 1, No. 3. 28 p. 20 January 1890. $0.75.

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